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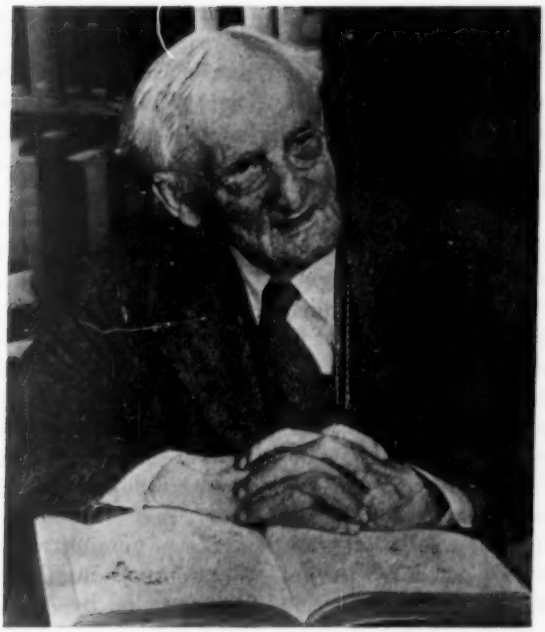
Schoolroom Science Center

Cornell Rural School Leaflet



Liberty Hyde Bailey and the Cornell Rural School Leaflet

By E. Laurence Palmer

In 1897, I was in the third grade. My teacher gave me a leaflet from Cornell University dealing with the collection of insects. Later, I learned that this publication which meant so much to me was prepared by Anna Botsford Comstock with the backing and encouragement of Liberty Hyde Bailey. I was able at that age to read and to use Mrs. Comstock's bulletin, but though I tried my best I could not get interested in a bulletin Bailey wrote for children on how to read an apple twig. Some years later I tried Bailey's bulletin again and this time I found it most helpful. For at least a half-century, Bailey was to me a force on which you could depend to get sound, appropriate help and encouragement in the nature-study field.

During the third of a century when the Cornell Rural School Leaflet was my responsibility, I again and again fell back on Bailey's philosophy, example, and direct help when crises arose. He

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The Schoolroom Science Center

By Eva L. Gordon

This Teachers' number of the Cornell Rural School Leaflet is planned to supplement the two preceding Teachers' Leaflets, *Outdoor Nature Studies* (Fall 1953) and *Indoor Nature Studies* (Fall 1954). *Outdoor Nature Studies* contained suggestions for experiences with plants, animals, and the physical features of the environment in their natural setting. *Indoor Nature Studies* dealt chiefly with studies of living plants and animals and their physical environment in the classroom. To suggest how a schoolroom science center may contribute to some of these and other science activities is the function of this Leaflet. It is concerned with extending and recording science learnings, meeting special interests and abilities, developing skills, and providing opportunities for shared experiences.

Schoolroom Science

Wherever they live, and whatever they do, in and out of school, children meet problems that involve both science experiences and science understandings. They achieve these understandings best through first-hand experiences and actual, purposeful contacts with materials, forces, and processes that affect their own lives.

In school, science experiences may enter into the daily activities in several ways. Science may have a place as a separate subject of study, and understandings may be developed through planned experiences and organized units. Incidental science experiences often make important contributions, since they usually arise from questions and problems of daily living or grow out of children's discoveries or special interests. Science experiences frequently are connected with other school subjects: social studies, reading and literature, health and hygiene, safety, art, mathematics, and others. The science center may serve as a setting for much learning in these fields.

In each of these types of science experiences, the schoolroom science center can play a part. A schoolroom science center need not be a fixed, definite place. Sometimes it may be only a bulletin board, or a table, or several desks pushed together, or a corner shelf, or even a window sill. Sometimes in an ele-

never failed me. I am sure that but for the backing he gave Mrs. Comstock and other pioneers in the nature-study field, nature study at Cornell would never have developed as it did.

At the end of the past century, agriculture was in a critical condition. Bailey saw in nature study an opportunity to help people appreciate rural life more fully. He called to his assistance the best talent in natural history that Cornell and other places had to offer. Simon Henry Gage gave us his classic on the common toad. Tarr gave us the story of a handful of soil that was much better than much that is now given us by soil conservationists. He also wrote a classic on a summer shower. H. D. Reed gave material most helpful in the study of fishes, and a host of younger folks began writing with exceptional skill about things that had to do with brooks. Bailey introduced the series with the sentence, "A brook is the best of subjects for nature study."

So successful were these initial efforts that a staff had to be developed to answer the correspondence that had been stimulated. A number of junior staff members of the university "won their spurs" answering questions from rural New York folk who had been stimulated by this material that was sound and that came from Cornell. The Rogers sisters who contributed so much to the influential "Nature Library" published by Doubleday, and Miss Flora Rose and Miss Martha Van Rensselaer who founded the College of Home Economics were among these. Back of it all was the guiding influence of Liberty Hyde Bailey.

Bailey has been and will be recognized the world over for the literature he produced and sponsored in botany and agriculture. Great as the influence of this effort may be, it is possible that what he did for rural education may be even greater. In the years when support was needed, he gave professional respectability, personal encouragement, and unusual leadership as well as administrative guidance. The Cornell Rural School Leaflet was founded by Alice G. McCloskey but its field had been pioneered by others at Cornell. With the backing of Bailey who saw the vision of a sound rural education as well as the details of basic natural history, we like to think that over the years it has served a useful function. We like to think that the finest monument that will be erected to Liberty Hyde Bailey will find expression in man's ability to live and find greater happiness in the rural environment. If that is the case, we like to think that the Cornell Rural School Leaflet with his backing has helped build that monument. Bailey's death in December 1954 cannot stop wholesome development in the fields of human endeavor he loved so genuinely.

ticipation of the children. So, an elementary-school science center should provide a place to assemble, to make, and to store (or dispose of) materials and equipment, as well as a place to use them, and to share science experiences and learnings.

Probably most schoolrooms lack space to satisfy all these needs at one time. But a schoolroom science center is not just space—it is a center of activity. All that is really necessary is room enough for busy children and the "things of science" with which they are currently occupied. A small space, effectively used, can play an attractive, vital part in a science program—and may be easier to maintain than a larger area. Whatever its size, and whether its facilities are permanent or temporary, the science center should be a changing thing, reflecting the day-by-day interests and activities of the class. It is not an end in itself, but a part of a learning situation, a place for purposeful doing.

An attractive, well-ordered science center is likely to be a high spot in the classroom, a place to which the children—and frequent visitors—gravitate whenever a free moment permits. Here groups of children grow in ability to live, work, and learn together, to approach and solve problems. They learn to work safely and to utilize materials efficiently. Individuals can pursue special interests, develop special abilities, and contribute to group activities. There is abundant opportunity for first-hand experiences with real things as children collect and display materials in which they are interested and as they use those contributed by others. Schoolroom science can be related to science from home or to community interests or events; and each child's interest in and curiosity about his immediate environment can be enlarged to bring about better understanding of more remote situations.

For Children, by Children

If the science center is to contribute as it should to satisfying learning experiences *for* children, it should eventually be managed largely *by* them. To them it is entirely logical to care for the things they bring to school, espe-

From one tree, a million matches—an exhibit such as this, arranged by Joseph Kazlauskas, may recognize community observance of Fire Prevention Week.

mentary classroom it may be all these at once, reflecting a more or less temporary domination of class activities by the science aspects of the current program. As a kindergarten teacher remarked, "Last fall I set up a science table for my class. But it is impossible always to have *a* science table. Just now I have five." Sometimes, too, the science center may shrink temporarily, as other interests and occupations assume the leading role. But, where teachers and pupils have discovered the fascination of science, and an active program is in operation, the science center never vanishes entirely.

A classroom science center should be colorful and inviting. Ideally, it should provide for a variety of activities. It should be a place where children can go freely to read, observe, exchange ideas, plan and carry on activities, follow up outdoor or out-of-school experiences, arrange or examine materials, record learnings, perform or repeat experiments, and exhibit results. In a sixth-grade room, a group of children found in their science "corner" a fascinating opportunity to carry on and demonstrate experiments suggested in their textbooks and sometimes originated by themselves. They worked largely independently, and chiefly with materials brought from home, under the guidance of a teacher, who as Liberty Hyde Bailey once said of one of his teachers, "allowed a boy to grow." Many children profit from opportunities to repeat experiments, especially those performed first by others—it is one thing to watch someone achieve a result, and quite another to do the same thing oneself, and still another to repeat a process and to achieve the same result time after time.

The center should accommodate some living things, such as attractive plants, aquariums, terrariums, and, at least occasionally, animal visitors of various kinds. In it should be containers for flowers and other plant materials, and cages and other means of keeping animal visitors comfortable. *Indoor Nature Studies*, the Teachers' Leaflet for Fall 1954, dealt with these subjects.

The center should be a place where children's collections and other contributions can be effectively displayed, observed, and used; or where special displays from a museum, or provided by the teacher or someone else, can do their part to stimulate or to add meaning to science studies.

There should be a bulletin board for pictures, charts, drawings, and other exhibits; and shelves for science books and other materials and supplies. A table or some other space for work, for demonstrations, or for experiments in progress is needed, too.

Elementary-school science is usually taught in the regular classroom, and guided by the regular classroom teacher, with the active par-

room.) They asked whether this trilobite was also a kind of animal that had once been alive. Thus, the bulletin board committee had two questions that needed answering: "Was it plant or animal?" "Was it living or non-living?"

I brought out the Row, Peterson booklet, *Animals of Yesterday,* and several sets of pictures from my files: one of the "World We Live In" series from *Life* magazine, some pictures from the November 12, 1954 number of *Colliers* magazine, some pictures of dinosaurs, and several snapshots of dinosaur models taken at Dinosaur Park in Rapid City, South Dakota.

The children looked over the available materials and chose those that were to go on the board. One of the committee located a picture of a trilobite, and found the place of the trilobite on the color-plate of ages in *Animals of Yesterday.* She traced the picture and cut it out of green construction paper. A third question was proposed: "To what age does this animal belong?"

Discussion around the bulletin board had established the answers to the first two questions, but the third question the committee member had put up was unanswerable until the children knew something about the geologic ages. We discussed age: that we all live our lives in a series of ages: baby, child, teen-ager (adolescent), grown-up. We went on to the broader concept of different kinds of plants and animals living in certain ages and then disappearing. The story of the trilobite from *Animals of Yesterday* was read to the class, and the age was found where the trilobite belonged. Then they placed the cut-out with the tail "sticking out" so that everyone could see that "that animal had lived at that age."

The use of pins to hold exhibit items is well shown in this display, centered around a fossil trilobite, and arranged by a third-and-fourth-grade group.

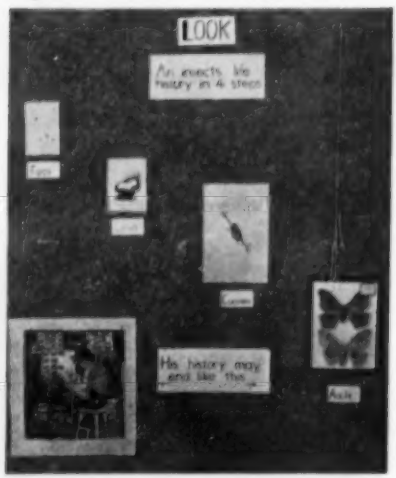
The black background for the book was a child's idea, as was the white background on green paper for the trilobite, and the orange border behind the sheet of mounted snapshots. Placing the trilobite in the center of the board, as the star attraction, was their idea, too.—*Lillian Bell*

cially if their contributions receive due attention and are put to suitable uses. It is important to help them develop responsibility not only for their possessions but for other materials they work with and enjoy.

Young children, and even older ones, may need training by way of small, simple undertakings and guidance to develop standards. But as they grow in skill in handling materials and in ability to work together, they should more and more take the lead in planning, arranging, and caring for the center, with help from the teacher only as they definitely need it.

Committees, changed from time to time, may assume this responsibility, or individual children may act as temporary "managers." How some teachers have met this problem is brought out by Patricia Adams (pages 17 to 26), by Ruth Josephson (pages 26 to 30), and by other teachers whose reports of science centered activities make much of this Leaflet a vivid record of science in action.

This life history of a Polyphemus moth, arranged by Dorothy Tappe, grew out of the chance discovery of a cocoon, and the later emergence of the moth. The insect mount at lower right was substituted for a cage containing the living insect, which was freed.



A Committee at Work

Our school yard contains many rocks with fossils in them. On a recent nature walk, several of these were picked up and brought to the class. Most of the children (grades 3 and 4) had vague and general ideas as to how they "grew in the rock." Some had no idea. As a continuation of a previous discussion on living and non-living things, I asked them to classify all the things they had brought in from the schoolyard. Much discussion evolved from the fossil-rock, with a final decision that the rock was non-living but contained the imprint of a once-living animal, although fossils could be plants, too.

The following day a fossil trilobite came to class. The children were fascinated by it, and wanted to display it (bulletin board displays were nothing new in our

A Gray Squirrel Problem

The first grade was deeply resentful. Gray squirrels were stealing food from their bird feeding station placed in a tree so they could see it from their window. Hostility toward the squirrels increased from day to day until Helen Hoffman, their teacher, decided it was time to promote a new viewpoint. The question, "Are the squirrels really stealing, or just hungry?" led to a discussion of what other foods the animals could find, and "How do they get into the feeder?" and "What can we do about them?"

Reading to learn what squirrels eat disclosed other interesting facts about squirrels: the different kinds, their differing sizes and ways, the areas they live in, what they do in winter, where their nests are and what they are like, when young are born and how they are cared for. It also resulted in an increased acquaintance with and use of sources of information. Books were brought from children's homes and sought in the school library. A science "reading" center came into prominence.

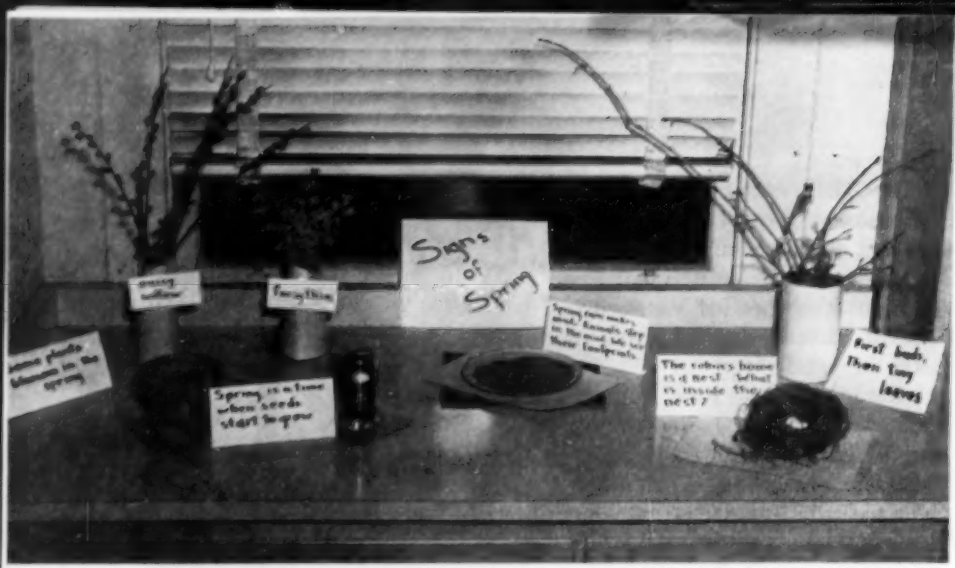
Squirrel foods, natural and otherwise, were collected, observed, discussed, and shelved for safe keeping. Field observations indicated that natural foods might not be easy to find. Pine cones, acorns, and hickory nuts were discovered. Finding, extracting, tasting, even planting pine seeds was an adventure. But what a lot of work for so little food!

By observation, the children discovered that the squirrels jumped from the tree trunk to the feeder. They measured the distance and marvelled. They watched the squirrels as they ate different foods, and as they came and went, but they never did learn where their winter homes were.

Resentment and hostility began to give way to interest and curiosity, to increasing understanding, then to sympathy—downright fondness for the squirrels in some children; in others, a desire for tempered restriction of squirrel activity in favor of the birds. A separate feeder for the squirrrels might help! But maybe the best thing to do now was to supply squirrel food *and* bird food, enough for both, and let them both use the feeder.

Then the display began. It was to tell the story of their feeder to a class at the University. First, the title—selected by vote, after several suggestions had been made and rejected. By elimination and compromise "Grey Squirrels Eat the Birds' Food" was selected. "Free Food at Our Bird Feeder" and "Food He Must Find and Fix Himself" were accepted subtitles. The display, by common agreement, was to represent the scene from their school window, including the feeder, of course.

Each child made a large sketch to show what might go into the display. These were examined, and



The exhibit pictured above is described on page 32.

Displays and Exhibits

Two types of displays are likely to play an important part in the activities of a schoolroom science center: (1) *bulletin boards* and (2) table or other horizontal-surface displays that in this Leaflet are called *interest centers.* Each may contribute to any one (or more) of a number of purposes, for example: to introduce a new unit of study; to follow up outdoor or indoor experiences; to stimulate and guide research; to record progress; to summarize learnings and emphasize meanings; to stimulate discoveries and new experiences during leisure hours; to present children's questions and their answers; to promote conservation; to help develop desirable attitudes; to invite creative work; and for the pure pleasure of sharing experiences, discoveries, and appreciations.

The following account of the production of an exhibit by a 25-member first grade and their teacher only partly portrays the learning situation of which the display was a part, but it does indicate some of the values achieved. Helen Duncan tells (pages 12 to 14) how a bulletin-board display that recognized a fossil discovered by a third grade child became the starting point for an extensive study of animal life through the ages. Anna Sibley's account (pages 14 to 17) illustrates how an exhibit planned to introduce a limited study may result in unexpected and highly valuable learnings.

interesting things as they could. They found pictures of some of the very fossils in their room. They enjoyed learning the long names of the animals. The children found that there were men and women who spend their lives studying life long ago, and judged that it was a difficult study, because at the time of these creatures no man was living. More pictures began to appear, and soon our bulletin board and science table were dedicated to life long ago. A fossil fern, which made a trip to the University to be identified, was discovered. It proved vastly interesting because it "probably came from the coal region of Pennsylvania."

Our study of fossils led us to a study of the development of animal life through the ages. The children were particularly interested in the age of dinosaurs and spent much time talking, reading, writing stories, and drawing pictures about them. They came to understand that no man was living at this time either, and that we have learned about these animals chiefly through fossil bones found by scientists who have studied animal life and evolution. The children began to realize that the pictures of dinosaurs in the books are only what the scientists think they may have looked like, judging from their fossils; that the stories tell what scientists think must have happened then, based on careful study of the fossils and of the places they were found; that even their names were given to them by men who studied them long after the last dinosaur had died. The children especially enjoyed the stories about dinosaurs in *Animals of Yesterday*. Many discussions arose from them. A slide-film of life through the ages helped to form a clearer picture in the minds of the children and gave them a better understanding of the length of time.

The children decided they would like to make some dinosaurs to show others how they looked. A day or so later we started paper mache dinosaurs. Although the task was somewhat difficult, some children succeeded in making Diplodocus, the largest dinosaur, Stegosaurus, the dinosaur with protective plates, a flying reptile, and others. While some worked on these models, others made a background to show what they thought the earth may have looked like then.

At last our study brought us to animals of today. The children learned that animals are divided into groups and that we are included in the mammal group of the animal kingdom. Many questions were asked about various animals. To answer these the children divided themselves into groups according to their interest. The groups were mammals, reptiles, amphibians, birds, fish, and insects.

It was not long before they found that some of their questions concerned animals that did not fit

The grey squirrel exhibit, in a corridor display case at the University, was made by a first-grade class.

good points to be incorporated in the final exhibit were chosen. Two "pictures" were selected as guides for making the background. Then committees went to work: (1) to draw the background scene in crayon on the gray side of project paper; (2) to find and cut a branch to represent the tree (a blown-down oak limb, sawed to size with adult help served nicely); (3) to construct a miniature feeder (it could be raised and lowered, like the real one); (4) to cut out and color squirrels on their way to the feeder; (5) to letter titles; (6) to select, gather, label, and display "feeder" food and "wild" food. The "work space" function of a science center required several areas!

Assembling the display and adding the finishing touch—a colored picture of a gray squirrel from an old magazine—left the children free to admire their achievement before it traveled to the University But perhaps only the teacher realized the varied values of the whole experience.

Animal Life Through the Ages

In early spring a child in my third-grade class brought in some rocks that had "funny shapes" in them. During sharing time that day she showed them to the class and I told the children that these were fossils of little animals that had lived millions of years ago. The children asked me to put the number, *million,* on the board so they could see how it looked. Although they could not imagine a million years, they knew that it must be a long, long time. We tried to bring about a better understanding of this by talking of their own ages and those of their parents and grandparents.

From that day on other rocks were brought in, some almost too big for their owners to carry. The children were thrilled that they could find fossils right in their own yards. They wanted to know many things, such as "How are fossils made?" "What happened to the little animals?" "Are there any like them living now?" From books, particularly *Animals of Yesterday* (Row, Peterson unitext), and from classroom discussion, they learned the names of these little animals, where they lived, how we know about them, and as many other

into any of these groups, the snail and the crayfish, for example. These animals were familiar to the children; some of them had been brought to class. One of the children seeking answers to her questions, asked at home and went to the library for help. It was through her that the words *invertebrate* and *vertebrate* were brought into our discussions.

After small-group discussions and study of books, the groups came together and shared what they had learned with each other. We checked to see whether we had found the answers to our questions. The children asked to make their own booklets about animals, and this, too, was done. Usually we wrote the stories together, but those who wished added special items they wanted to remember.

Live specimens brought into our classroom made our study much more meaningful. Specimens came not only from our class but from other classes as well. Of course the children wanted to keep them. We discussed the importance of keeping them comfortable and well fed. It was decided to watch our animals for a few days and then to free them.

The children wanted to share what they had learned with the other grades in the school. They decided to have a "Zoo" to display the animals and to show what they had learned about them. Small groups worked again putting up their own exhibits—bulletin board displays, books and magazines used, stories about "their" animals, and the most important feature of all—the live animals. Each group had at least one specimen, except the bird group. A pet crow had been brought in a day too early and had to be taken home. The children of other classes came and went for parts of two days. After it was over, the children discussed what had seemed of most interest to the visitors. This was a difficult question to answer, but the children finally decided that the peepers and the baby rabbit had drawn the most attention.

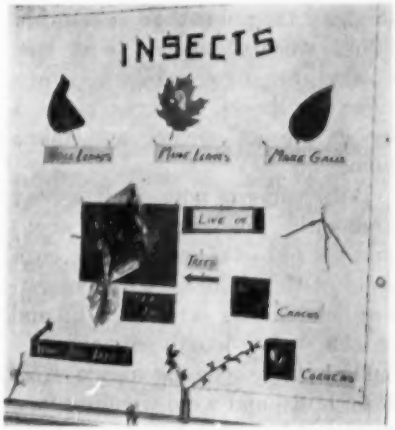
Although our study of animals has formally stopped, we still have (on June 1) our aquarium of tadpoles and snails. We have enjoyed watching them grow, and are anxiously awaiting the day when the tadpoles will have developed legs. Each day some child comes to tell me of something he has seen in the aquarium.

For me as a teacher, this has been a wonderful and exciting experience. It has helped me to realize how much children want to learn about the world around them and how happy they are when they find that their teacher is interested, too—*Helen Duncan*

Led Afield by Tent Caterpillars

It is amazing how quickly a few simple truths, put in the form of a bulletin-board display, can lead to unanticipated learnings for both the children and their teacher. In

April I had prepared the bulletin board shown on this page—as an exhibit for an adult group, intending to use it later with my second-grade class. I had planned it to lead to further study of the effects of insects on plants, and had featured, as a star attraction, tent caterpillars in their early stages of growth, securely (or so I believed) wrapped in a plastic bag, which I had pinned to the bulletin board to illustrate insect life in trees. Twenty-four hours later, some of the caterpillars had escaped from their enclosure by way of the pin holes. Then, weaving silken highways as they traveled to and fro across the blackboard (page 16), they went about their random search for food. Those that found food, in the form of choke-cherry twigs with fresh young leaves set out for them, grew, shed their skins, and then went on growing. By the end of a week the unfortunate majority had died, their carcasses littering the chalk tray along with frass (a surprising quantity of waste product from such tiny creatures) and old skins. What a wonderful learning situation this was for me, and for the others who watched these tiny creatures in their struggle to fulfill the two main functions of their larval life—to eat and grow. Once I broke one of the silken roads immediately in front of a traveling pair and had the opportunity to see the careful search of the caterpillars for the continuation of their route; their inability



The unplanned escape of the tent caterpillars from their plastic sheath led to the learnings described on pages 14 to 17.

to find it, though the gap was only ⅛ inch wide; and their return to the place from which they had come.

In my second-grade class, parallel learnings took place. We watched and talked about the strange little tent dwellers, who in their drive to eat and grow, became such pests on young fruit trees. We considered other insects and their ways. The children went about a strange sort of metamorphosis as they turned "insect" and, after first making their victim leaves of paper, proceeded to roll them, mine, and eat them, and build their homes on them, after their own choice. Onto the wall in our little hall classroom went each leaf, so eagerly consumed and manipulated by the "caterpillar jaws"—the scis-

sors. As time went on and other things were discussed, room was needed for new exhibits. Down came the leaves, each one claimed by its "insect" owner and taken home.

But, outdoors now, in late May and early June, something new—and yet old—was exciting the curiosity of the children. The tent caterpillars, having eaten their fill and grown to a length of about 2 inches, were coming down from their tents; and were wending their restless way over lawns, up trees, onto buildings—everywhere, it seemed. Eventually and inevitably some found their way (with a little help) into our second-grade classroom.

Then, in a few days: "You know those caterpillars we talked about, Mrs. Sibley? They are spinning cocoons. They're all over!" During the following discussion I inquired: "Did you ever notice that there are two kinds of tent caterpillars?" And added, "One has a long light line down its back, like this one; the other has little light-colored marks shaped like keyholes down its back." "Oh, yes, I've seen them; oh, yes!" was the immediate answer from some. I continued, "This one in my hand is the apple tree tent caterpillar, with the long unbroken line; the other one with the keyhole marks is the forest tent caterpillar. See whether you can find one of each next time you look for them." At recess time I was called to the teetertotter to "see the apple tree tent caterpillar." By the time recess was over several apple tree tent caterpillars had been located, but no forest tent

The plastic wrapping from which the tent caterpillars escaped was at the right. Their interlacing silken trails were clearly visible across the whole area shown. Breaks in the trails gave watchers opportunities to observe behavior of the wandering caterpillars.

caterpillar. The next day as I arrived at school, one of my second graders came up to me, her face puzzled: "Mrs. Sibley," she began, with a worried look, "I saw a forest tent caterpillar yesterday, but it was on an *apple* tree!"

Another day, another opportunity to learn and to teach! And a bulletin board may provide your new learning and teaching opportunity.—*Anna Grant Sibley*

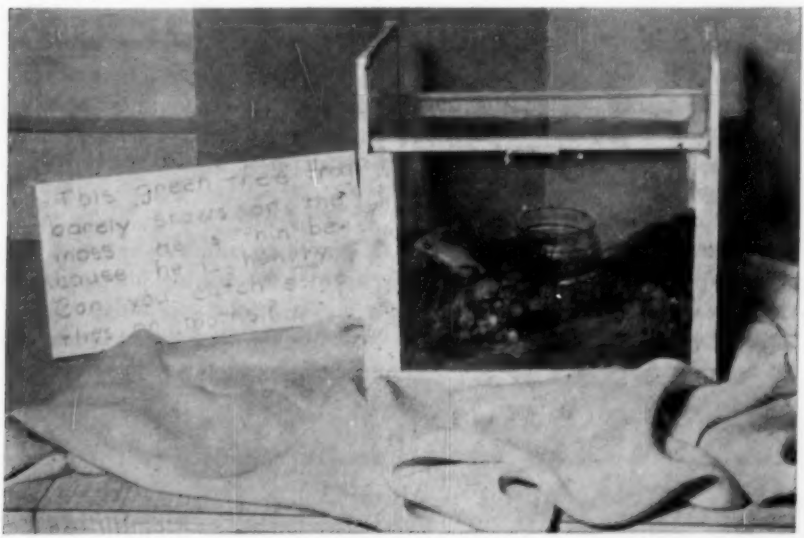
Note: A mimeographed bulletin giving further information about tent caterpillars (both kinds) is available from the Cornell Rural School Leaflet Office, Stone Hall, Cornell University, Ithaca, New York.

Notes on Making Exhibits

Most of these notes are suggestions contributed by Mrs. Patricia Adams, who says, "I first became interested in school science exhibits when I heard fellow teachers say they didn't want 'this junk' children collect in their classrooms—it collected dust, looked messy, and they didn't know what to do with it. Because I considered (and still do) that science is a vital part of children's experience, I worked diligently to prove, to myself at least, that these nature-study items are interesting and valuable materials, and need not be messy and unattractive."

So, instead of allowing these

An "interest center"—a green frog in a terrarium. Well-chosen color in the background and in the textile under the terrarium made this an eye-catching exhibit.



things to collect, as they frequently do, on a "Nature Shelf," or in a "Science Corner" or a "Nature Museum," Mrs. Adams sought ways to use them—"the more attractive, the better." Exhibits were one of these ways. "I think", she says, "that a teacher must develop a philosophy which allows her schoolroom to look lived-in, but that doesn't mean that it needs to be disarranged, dusty, nor full of antique collections. Let the children beautify the things they collect. With guidance, my third and fourth graders can do this pretty well. And they do better at the end of the year than at the beginning."

Bulletin Boards

"Bulletin boards are important," Mrs. Adams writes, "because so much of our learning comes through *seeing*, and because children love to see their contributions on display." Used as an integral part of a science center, the bulletin board can be an object of group planning, participation, and evaluation.

Bulletin boards or tackboards usually are a permanent part of classroom facilities. But additional vertical display space, or space "just where we want it," often can be provided by converting to that use such spaces as an extra blackboard or the back of a door, or by making portable display areas. Satisfactory materials are beaver board, insulating board or similar boards; plywood; corkboard; linoleum; a flannel board; or even stiff corrugated cardboard. Two yard-square pieces of corrugated cardboard, hinged together at the top, with a brace between for rigidity make a useful floor display area; or pieces may be hinged so that they open like the pages of a book. Mrs. Adams uses small easel-type boards, covered with colored paper, to display stories or pictures concerning classroom pets near the appropriate cages.

Bulletin boards should usually be framed—with wood, plastic tape, or some other binding—for greater attractiveness and durability. They should be big enough for effective use, usually 30 to 40 inches in vertical height. Their color should harmonize with the surroundings, and provide a good background for the items displayed—a requirement that can easily be met if necessary by a cover of paint, paper, denim, burlap, or monk's cloth. They are best placed at the eye-level of the students. Good light is important.

Interest Centers

"Interest centers are another device to keep science materials interesting, vital, and not dusty," says Mrs. Adams. "Items that cannot be displayed on a bulletin board can be exhibited in this way—on the flat surfaces of tables, shelves, desk tops, window sills, and such. These displays may occupy limited spaces, and usually allow closer inspection

than a bulletin board display. Hence, lettering on signs may be smaller, finer observations may be stimulated, the displays may be less formal, and they often are more temporary."

"Items of all kinds may be displayed in this way. A blue toy airplane, instead of being confiscated and placed on the teacher's desk, became an interest-center-for-a-day, displayed on an oblong of yellow construction paper and accompanied by a blue sign that brought about a brief discussion of how airplanes fly. Through a challenging sign, flowers brought to school become objects of scientific interest, and at the same time children begin to learn to use colors that combine well with objects they display. A demonstration or two by the teacher is enough to give children the idea of doing their own flower arrangements." *Flower Arrangement,* by E. F. Schaufler, 4-H Club Bulletin 98, available from the Mailing Room, Stone Hall, Cornell University, Ithaca, New York, and *Flower Arranging for Juniors,* by Virginia S. Marshall, published by Little, Brown and Company (1954, 113 pages) are helpful references.

Who Prepares These Exhibits?

Edgar Dale, in *Audio-Visual Methods in Teaching,* says, "An excellent exhibit can communicate learning no matter who has prepared it. This is another way of suggesting that some of your exhibits may be produced by your students and others may be your own handiwork—and still others may be borrowed."

It is desirable, however, to give elementary-school children as much responsibility as possible for planning and arranging the science exhibits in their classroom. True, the teacher needs to contribute occasional ideas; to guide mechanics—arrangements of items, proper spacing, use of color, phrasing of

These two "interest centers" on seashore life are described on page 37. (The sign at center front should be with the easel at the left.)

captions; to help develop exhibits in line with their purposes; and to share in the evaluation of their contributions. But children should do all they can.

"Arranging interest centers and putting new displays on bulletin boards becomes tedious for the teacher if she is inclined to be too accurate as to placement of materials," Mrs. Adams feels. "A free-and-easy technique is quick and effective, and if children are allowed to arrange the exhibits, that technique is easier for them and more enjoyable. In my room this year, one child, more responsible and more talented than some, has been in charge of the bulletin board. She has come to me at times and asked if she might change displays arranged by other children. She is quite discerning and tactful, and the other children seem to respect and profit by her judgment."

A Plan Is Necessary

Usually exhibits are *seen,* not read. Their main message must be evident at a glance, and their headlines must immediately catch the viewer's interest if they are to accomplish their purpose. As suggested on page 10, an exhibit may serve any of a wide variety of purposes. It should present only one central idea, although that idea may be simple or complex, and its development may be brief or long and detailed.

How much planning needs to be done to achieve the purpose and to develop the central theme effectively depends on the purpose, the complexity of the idea, the teacher, and the class. It may be wise sometimes to write out a clear statement of the idea and the purpose to be accomplished; then through sketches, using the proportions of the available space, to develop a layout plan.

The art teacher, if there is one, can be of great help in matters of design, balance, and use of color. Mrs. Adams gives one suggestion: "A rectangular shape is generally the most pleasing, and the upper lefthand corner of a rectangle is the spot readers' eyes naturally seek. If we initiate a display at that point, we must arrange the rest so that the eye has something to guide it." Mrs. Adams illustrated her point, using an oriole's nest for a rectangular bulletin-board exhibit. She placed the nest near the center. Then, in the upper left-hand corner she lettered "Orioles build" and, in the lower right-hand corner, "hanging nests," thus leading the eye to take in the whole of the idea she was presenting. But, she adds, design should be varied.

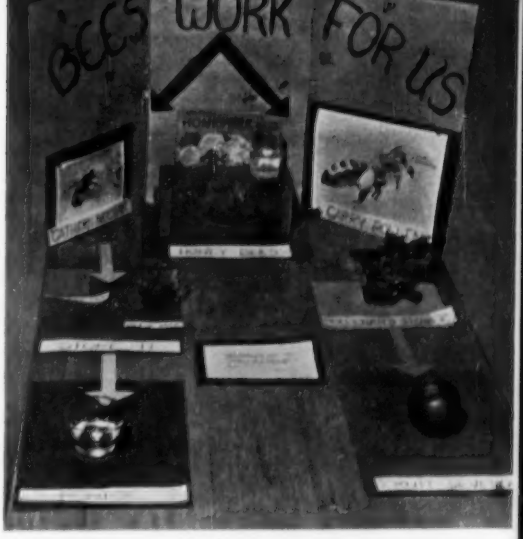
Use Color

Skillful use of color can do much to emphasize key ideas and materials; to integrate and unify an exhibit; to add to its attractiveness; and to direct the eye of the observer. But color must be used judiciously: too many colors may

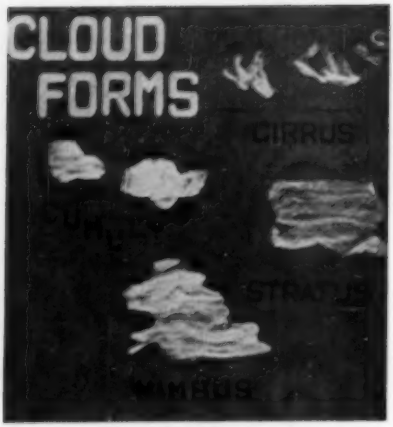
be worse than none; and color is valuable only when it makes an exhibit more effective. Usually two or three colors may be used on a bulletin board—one for the background and the others to accent pictures or objects and captions. Black, white, or gray may be added to supply contrast. Mrs. Adams lists as eye-catching colors when used on a white background: red, black, orange, brown, and blue, effective in that order. In order of legibility she suggests the following combinations: black on yellow, green on white, red on white, blue on yellow, blue on white, white on blue, black on white, yellow on black, white on green, and white on black.

Color in the exhibit materials themselves may determine the colors used in backgrounds and captions. For the latter two purposes, Mrs. Adams makes extensive use of both colored construction paper and colored poster paper which is "lighter in weight than construction paper, but comes in more pleasing pastel shades."

Both colored paper and pieces of variously colored textiles appear regularly in Mrs. Adams' interest centers. She says: "Coffee cans are good receptacles for seeds we plant, but they look better if a piece of colored construction paper is pinned or taped around them. If the paper becomes soiled, or we want a different color scheme, children can quickly change the cover. Cans or jars of various shapes and sizes can be transformed to appropriately colored 'vases' by the same treatment. As a 'base' for an interest center, we sometimes choose paper of two or three different colors, place the display items on one piece, then offset the other one (or two) underneath so that partial borders show. Or, we lay the two or three pieces one above the other, cut them together in an irregular shape, then offset the pieces and place the display item on the top one. Or we may place the object on a large piece of colored paper and put a label of contrasting color on one corner."



Bees work for us—this attractive exhibit by Joan Skillicorn featured a small observation cage of live bees and large-scale photographs of the insects. It emphasized honey-production and pollination. The color scheme combined yellow and brown.



In the tackboard display illustrated here, cotton "clouds" and cut-paper letters (black and white) were mounted on medium blue paper.

"Textiles, to place under flower arrangements, 'experiments,' things to watch, or collections, add color and interest. We keep several pieces of different colors and patterns folded on a shelf in our schoolroom, from which children can choose when they make an interest center. Rayon fabrics lie especially gracefully, but some cheaper materials do very well."

Materials, Supplies, and Tools

One may use in an exhibit anything that contributes to teaching effectiveness. "Real things" probably have the highest value in establishing true concepts. But models, industrial exhibits, pictures, posters, cartoons, silhouettes, graphs, even newspaper clippings may have a place. Children's drawings, poems, stories, and things they make or use are valuable, too.

Many of the necessary tools and supplies, such as paper, cardboard, paints, inks, crayons, rulers, scissors, and hammers are familiar equipment in elementary classrooms. For exhibit use, a tacker that can force staples into moderately hard surfaces is invaluable. Rubber cement and Scotch or masking tape have many uses. Lettering pens, felt-wick pens and the special ink they use, and medium-to-small brushes make preparation of captions quicker and easier.

To hold display items in place, Mrs. Adams prefers pins—the size and shininess of thumb tacks detract from the attractiveness of a display, she feels. If, however, bulletin boards are so placed that children brush against them, thumb tacks are safer, but they leave small holes in some kinds of boards.

Containers of all sizes, shapes, and materials meet a variety of needs, many of which are suggested elsewhere in this Leaflet. Exhibits may even include caged animals; and plant specimens on display can be kept fresh in water in vials or test tubes or even in paper cups which can be easily attached to bulletin boards. A changing exhibit of spring flowers

in paper cups stapled to a corridor display board attracted visitors from all parts of one school.

A magnifier of 4-inch diameter or larger is a valuable addition to a science area.

Labels and Signs

Labels, titles, questions, directions, and statements that point out purposes and meanings all contribute to the effectiveness of displays. They must catch and direct attention and do their part to achieve objectives. In elementary-school science displays, they should usually be short and simple, and always legible. Their phrasing offers a real challenge.

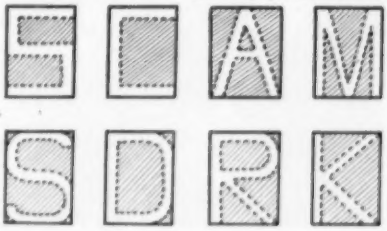
"Lettering seems to pose a problem," writes Mrs. Adams, "but instead of doing it all yourself, train the children to do some of it. Let children who finish their work first help with the task.

"For large signs, cut-paper letters show up best. Even third-grade children can learn to make them. Show them how to fold and cut paper into equal-sized squares or rectangles. Then by cutting out two or three letters yourself, show how to use the outside of the piece of paper as a guide. Square-cornered letters are easiest—you just cut in from the outside as necessary to form the desired letter. Letters may be rounded easily, too. Round off the corners first, then cut in from the outside to complete the letters. As you work with cut letters you learn certain things about making and placing them. For example, O's should be cut from a slightly narrower piece of paper than M's and W's because O's look bigger—they have a big hole in the center. T's and L's often do not "look right" if they are spaced at equal distances from other letters in a word. Children's work will be irregular, but arranging the letters not in a straight line makes the irregularities less noticeable and may lend charm.

"Painted letters are next best, and painting can be done even more quickly than cutting. Paints in use in most schools these days are water-thinned colors that are bright, clear, and opaque. They come under various names: poster

Letters, square-cornered or rounded, may be cut from pieces of paper of uniform size. In the illustration, dotted lines show where to cut. Shaded areas are to be cut away.

Drawing by Doreen Pereli



paints, tempera colors, and others. You can buy them ready mixed or in powder form, to be prepared as they are needed. Children are more likely to feel competent to paint letters than to cut them, but they may need guide lines to maintain even height. And again one cannot expect perfection.

"Children like to use crayons for pictures and printing, but crayon work does not show up well except at short distances.

"Signs may be rectangles or squares, lettered in straight lines; or, for variety, lettering may be less formally arranged on an irregularly shaped background, or the background may be cut to follow the outline of the printing. Sometimes a science object brought in by a child is discussed so thoroughly that no label is needed—we just display it attractively for a day or two.

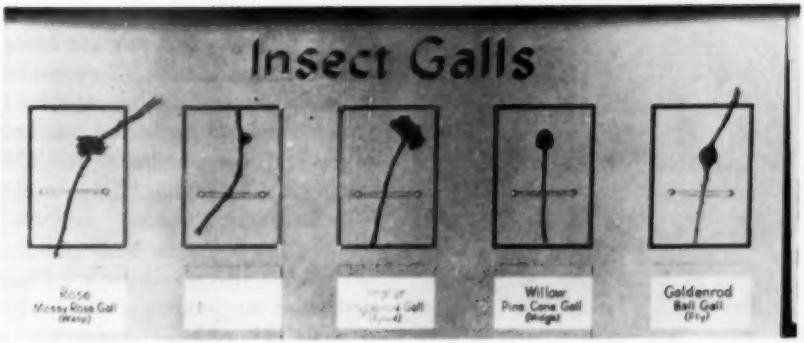
"Signs for interest centers can be smaller, with smaller lettering than those for bulletin boards. Those done by children are most successful when made on ruled writing paper, although they like to use black crayon on colored construction paper. Fastened to folded pieces of tagboard, these labels become stand-up signs."

Altogether, signs and labels offer endless opportunity for the exercise of ingenuity and special abilities, as well as for choosing and presenting significant content.

A short trip "to catch snowflakes on our sleeves" led to this exhibit of cut-paper snowflakes and letters on a blue background.

Invite Participation

Provide ways for observers to feel a part of the exhibit. Include objects they can handle, lift, feel, smell, and watch, as well as see. Give them things to do. An exhibit of shells from Hawaii, for example, included a small, covered box, labelled, "Take a peek." The reward for following the direction was an opportunity to examine jewelry made from shells. A printed invitation to use a wooden hammer on a homemade wooden xylophone drew observers into an extensive exhibit on sound.



The exhibit of insect galls shown was planned to invite participation. As specimens were brought in they were fastened to the white exhibit spaces by rubber bands attached to round-headed paper fasteners. The white label cards were slipped into slots fashioned from double layers of stiff cardboard. Thus a changing collection could easily be maintained. (The second gall from the left is an oak-bullet gall, caused by a wasp; the middle one, a popular vagabond gall, caused by an aphid.)

Ask questions that almost *must* be answered, such as "How many different materials can you see in this robin's nest?"

Invite children to form committees (of one or more) to see what they can learn about materials on display. Suggest that they summarize their findings on a card or report to the class; and that they cite their sources of information.

Occasionally use a 2-by-2-inch slide, scotch-taped in a hand viewer, to present a picture, a question, or a bit of information.

And, remember, time spent just watching exhibits is usually not wasted time. A 15-minute "wiggle-watch" beside an aquarium, or minutes of following the movements of wandering tent caterpillars, or watching a snail eat may provide exceedingly profitable and satisfying experiences.

Evaluate

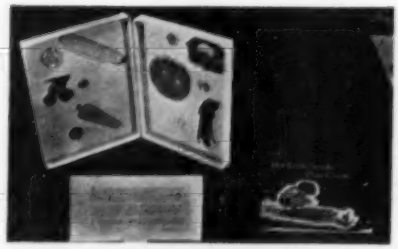
Each teacher and her class will have their own ways to judge the worth of their exhibits. But questions such as the following may help to start discussion:

Would you look at this exhibit if you had not produced it? Why?

Do other persons look at it? Why? How long?

Does it show what we planned it to show?

Do persons who look at it learn what we wanted them to learn?



A description of this exhibit for little children is on page 39.

Exhibits Have Their Day

Be ready to dispose of display and exhibit materials when they have served their purpose. A stale outdated exhibit is worthless. Usually disposal of materials, including storage of those worth keeping, is a logical step for everyone concerned when an organized unit or a planned study is brought to a close. The special treasures and the incidental "finds" are more likely to be left uselessly occupying space.

As Mrs. Adams puts it, "There has to be a way to disperse these collectors' items before they become hallowed with age. The children usually seem to be most practical about it. They can see there is no room for new material and are willing to help weed out the old. So we gather up the pebbles George brought to school, or the bright colored leaves already turning brown and curling up. We inquire whether the owner wishes to take them home. If the answer is, "No," we offer each treasure to anyone else who would like it. If no one is interested, we all agree to throw the material away. Occasionally there may be something we wish to keep for future use, but in general that is not true. The business of throwing things away permits a good review, and, besides, showing the item to the whole class was usually much more important and much more interesting than its final disposal."

About Bulletin Boards

ALONG, sustained, painless case of laryngitis several years ago was without a doubt one of the best teaching aids I ever had. Never before had I realized how many words I spoke during a teaching day; necessary words, perhaps, but hardly those to enrich the lives of the listeners—directions, precautions, reminders, of immediate but usually not of lasting value. Most of us who love to teach feel that days are woefully short, that each leaves us much choice material untouched; that too often children go home with small satisfaction in areas in which their ability and interest are strong because we have been unable to give them the few extra minutes necessary to direct them to independent thought and action; that other children need extra attention, too, to help them "catch up" because of absence or because they just need more time and practice to absorb the daily lessons.

Perhaps this situation cannot be eliminated in our crowded classrooms today, but it can be eased. There must be many ways, of course, to do it; I found great value in bulletin boards not only for science, but also in the general program of a first-grade class. The combined effects of the laryngitis and of some long tucked-away advice from a wise state supervisor woke me to possibilities I had been lightly passing by.

In my mute condition I had to find ways to communicate with the children with the most efficiency. I soon ran out of blackboard space, but the room, like most other rooms, had four walls. One bulletin board at the moment was graced with Halloween masks. Another had pictures from magazines, unlabeled, but gay and colorful. The topic they represented, however, had been concluded earlier in the week. Nothing of import had been added to the display since then. In fact we had grown accustomed to having it there and could pass it by with little notice. From out of the past came the voice of that supervisor, "I have nothing against tulips; but if you're going to have borders of tulips in your room, then *learn* something about tulips!" On his spring rounds he had met tulip borders in practically every other school he visited. So he had become a one-man reform committee. His reasons: School is a place for learning, space is at a premium, and no learning is likely to result from letting a vacant gaze wander across rows of tulips—or Halloween masks, or unlabeled pictures. His suggestion: if you are going to use a border or a bulletin board, make it a thoughtful one—one that is a silent teaching situation; one that "reaches out to something beyond a pretty picture."

These thoughts came to me as I searched for ways to do without a voice. The masks and pictures came down and a general rejuvenation took place. Some of the things I learned and still value highly may be of use to other teachers.

I discovered at least three kinds of bulletin boards: two of them "reach out" and the third is purely for vanity's sake. This latter is the "result" board. When a class has had a happy time learning what they can do with magnets, illustrating a favorite story, creating mystical, magical beasts, or cutting and pasting something that represents a difficult discipline in control of materials, I feel perfectly justified in displaying the results. This is not a reversion to the tulip border; it is not done just to fill space. If a lesson is worth doing, it is worth recalling. I think as a group we have a right to spend a few days admiring an accomplishment. There is satisfaction in that and children need it no less than adults. Here, length of time of the display seems the important thing. A few days of enjoyment and we begin not to notice it any longer. When a dis-

play is passed by as easily as the pattern in wallpaper, the time is ripe for change.

The second type of bulletin board I call *the clutter board,* a name bestowed on mine, not unkindly, by another faculty member. This is the children's area, wholly and independently theirs,—a children's board with children's standards. To the children it is not a clutter; rather it is filled with vastly interesting items that are not propounded by the school. Perhaps there is something psychological about this; perhaps that's what keeps the interest high. At any rate, the standards are theirs, both in methods and materials.

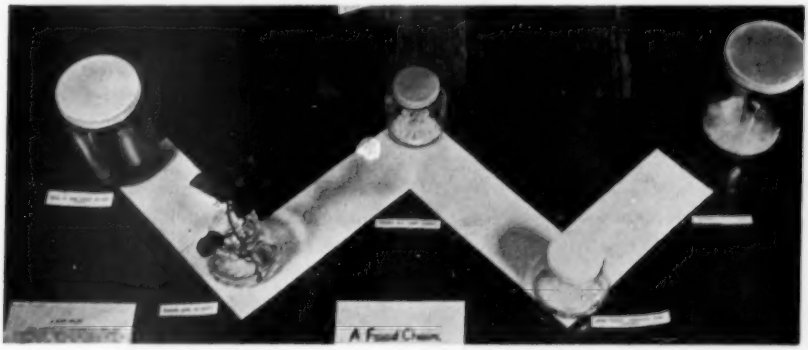
The little fellow who can't bring himself to stand before the group to "show and tell" will draw a picture and pin it on this board, probably when nobody is watching him. Some youngsters cut from magazines and newspapers pictures and articles about special interests that are never mentioned in class—subjects that may be a far cry from the curriculum outlined for the grade. Yet a little imagination and ingenuity can pull these unlikes into interesting relationships. For example, a sixth grade I knew was studying Greece, but Peter had disoriented himself from the group for days. His contributions to the clutter board had been several star maps and an article about a planetarium. A book containing star myths by the ancients was the tie that once more bound him to the group. (This sort of thing happens when one takes time to look at the children's board and to note who offered the materials on display.)

Neatness of the clutter board will vary according to age and ability. Middle graders have a strong sense of design as well as fair play. They will not allow monopolies. Sometimes children will chose a class member they look up to for fair play and quiet leadership. They are occasionally quicker than the teacher to see in someone an aptitude for neat lettering and effective arrangements. Or it may be the teacher who will choose a child for this type of ability not yet recognized by his classmates who may excel him in other things. Primary children need a helping hand—when they ask for it. A committee or manager may have to be chosen to keep things under control and see that old items are removed and reclaimed by their owners. I find this works better when instigated as a result of difficulties. If too many restrictions are set up in the beginning and it becomes a chore, the clutter board will be short-lived and unproductive. Duration of display, spacing, mounting, and labelling offer opportunities for problem solving and group work. The children are brought together by sharing interests, and often are stimulated to discover and develop new ones.

Type three is my own board, and I am as jealous of it as the

children are of theirs. Here I can do what I wish, from some "terribly clever" review of an old and troublesome lesson, to ideas for modern art, or stimulus for a new science project. I can be formal or informal; I can arrange it myself or assign it to a class committee who will work under my direction. I prefer to have my board at or near the front of the room, where the wandering eye comes to rest most often; for I like to think, at least, that this silent teaching has several effects; that it gives a sense of orderliness of color and arrangement (I sometimes go so far as to measure distances) and that it stimulates thinking. I can use every trick of the trade from peep shows to 3D to create interest. A shoe box with a window cut in it may harbor anything from a small living creature to an important notice I want everybody to read. Small shelves can be built of oak tag or construction paper to hold "real" objects or they can be wired or pinned on. Questions and captions can be devised to lead to experiments, to observations or to the use of books available close by. Often a series lesson can be taught with nothing more than good pictures and captions: paper-making from the forest to the mill, with a follow-up study of paper products. (I have found follow-up lessons useful and rewarding, for they tell me who has done the work in this particular field, and how much understanding has been gained.) This bulletin

This striking exhibit, arranged by Doreen Perelli, was an outcome of a fourth-grade study of "What animals eat." From left to right, specimens and labels point out that (1) soil is the basis of all life; (2) plants grow in soil; (3) aphids eat plant juices; (4) ants "milk" honeydew from aphids; (5) salamanders eat ants.



Exhibits—Examples and Suggestions

THE brief reports on the following pages are of two kinds: accounts of actual classroom exhibits, and descriptions of displays, planned to meet a variety of interests and purposes. These examples and suggestions are presented not as perfect products, but only as possible helps for teachers and children working in various science areas. They can, and should, be varied to fit different situations or objectives. Other displays not described here are pictured throughout the Leaflet. Although most of them fall in the field of biological science, physical science studies lend themselves equally well—perhaps even more easily to display projects.

Signs of Spring

Seasonal displays are effective media for learning and offer rich opportunity for creative planning. Anne Marcy's interest center (at right) is an example. She says, "I planned this interest center to be used in early spring when the first bulbs are coming through the ground. . . I got a wooden flat from the florist, lined it with aluminum foil to make it waterproof, and filled it with soil. Then I dug bulbs that had begun to peek through the ground in our backyard, and planted them in the box. The pictures I obtained from flower catalogs and mounted on colored construction paper." Some realistic artificial tulips and daffodils she discovered added a three-dimensional value. Strings led from wooden sticks inserted near the bulbs to the appropriate labelled pictures, and helped to associate bulbs, flowers, and names. This exhibit proved of great interest to the many persons who watched the young shoots lengthen, buds appear, flowers open, and finally the fading plants that brought about the removal of the exhibit, and the satisfying appreciation that the bulbs could be replanted in the garden to bloom again another year.

Because this growing exhibit changed from day to day, it held the interest of its audience from the day it was set up until faded flowers and yellowing leaves suggested its removal.

board has offered a satisfying way to deal with questions that arose from small groups and which could not be handled adequately in class time. Maple syrup from tree to pancakes, milk from cow to dinner table, a letter from mailbox to mailbox—social studies, science, arithmetic, spelling—all find a place on my board and appeal to some in the group. To try to reach everybody every time is to court despair. Certain things everyone must do, such as march in a fire drill and learn the multiplication tables; but bulletin boards to be fun must have strong interest appeal. If they look like fun and lead to individual activities, most of the children will be interested most of the time. The bulletin board is often the answer for "What shall I do when I have nothing to do?"

Good ideas on my board often carry over to the clutter board. Through the year choice of materials, labels, use of colors for mounting, and effectiveness in arrangement improve. Indeed I have found more than once that some of the best ideas for display do not emanate from my board. I have found, above all, that "easy does it" in preparing a board. If it is as important as I think to have a fresh, new display often, then I cannot be a perfectionist in all things. It is important for me to be neat and accurate because my work must be a model in writing, lettering, spelling, and all the skill subjects I teach. I want to develop good taste insofar as I understand good taste. But I cannot and do not re-letter an entire poem if one letter blurs, or send for a new ream of paper if one corner of the last sheet is torn. Neither do I ink over carefully penciled letters; I start with ink or crayon or whatever medium I have chosen. I find a kit handy, so that tools and materials can be kept in order, apart from the general classroom supplies. Mine was a cardboard box that contained a long-bladed scissors, a box of crayons, an alcohol pen, a ruler, some cut-out letters, thumb tacks, scotch tape, and a small, firm brush I especially prefer for lettering. The kind of stapler that opens up flat cuts mounting time to almost nothing.

Teaching may be a "position," but it is also a mighty hard job. It is only natural to try to find ways to minimize effort with optimum results. I have found using bulletin boards one of those ways. If they were hard to set up and tedious to do I know I wouldn't do them. But they aren't. They save hours of talking, and add hours of teaching. And because my ingenuity has been tapped again and again teaching has become more nearly the creative experience it was meant to be.

swer list. Although welcomed as a game, the activity would make a significant contribution to many science studies.

A "Feeling Table"

The chief purpose of this "interest center" for young children, arranged by Anne Zehner, was to develop appreciation of differences in texture. Objects used included a piece of moss, a wooly mullein leaf, a spiny holly leaf, a smooth stone, a small dish of sand, a rough piece of bark, and several others. Each was displayed on a background of colored paper, cut to conform to its general size and shape (glossy gift wrappings in dark green and dark brown were used). Children were encouraged to pick up the objects, feel them, then put them back in the "right place," thus adding awareness of differences in size and shape as well as variations in texture.

An Appreciation

An attractive bulletin-board exhibit, arranged by Naomi Eckstein, had two purposes: to develop appreciation of "the forms which water takes and the work that it can do;" and "the possibilities of a camera as a recorder of natural phenomena." Beautiful photographs, in color and in black and white, effectively mounted and labelled, led many visitors to pause for leisurely examination and discussion.

Floating and Sinking

Nancy Fraser presented this interest center in a kindergarten "to set the children thinking about water." A large copy of the sign pictured above called attention to glasses of water, arranged in pairs on squares of bright red construction paper, each glass containing some experimental object. Well-placed labels stated and inquired:

A feather floats. Why?

A stone sinks. Why?

One bottle (a small water-filled vial) sinks. Why?

One bottle (a similar vial, air-filled) floats. Why?

The bigger one floats. Why? (a cork in one glass, a penny in the other).

Wood floats (two pieces of wood of different size and shape, in different glasses).

Water is heavy—a wet piece of paper sinks (one glass contained a sunken square of blue construction paper; in the other, a similar dry square was afloat.)

Eventually the pieces of wood and dry paper became wet and sank—this led to more learning.

More Signs of Spring

Judy Giddings and Sandra Nichol, in an early April interest corner (page 10), suggested future outdoor events to watch for. There were forced pussy-willows and forsythia, and tree branches with forced buds, each in a tin-can or other improvised container disguised by a taped-on wrapping of appropriately colored construction paper. April showers were foretold by a tray of mud imprinted with a dog's footprint. A last year's robin's nest with blue-painted clay eggs (carefully correct in size), and a colored picture of a robin suggested the spring migration; and containers of young radish plants and sprouting bean seeds completed the preview. The exhibit was intended to stimulate observation of outdoor spring phenomena.

Third Grade Signs of Spring

Helen Duncan's third grade was bulletin board conscious. She decribes their work as follows:

"As spring came to Ludlowville, so it came to Lansing Central. The children began bringing spring to our class in word-pictures as well as through samples of things they saw. In their spare time, some of the children drew pictures of birds that they had seen. Mildred brought in several twigs, including oak and lilac, with buds just beginning to open. She was much interested in the signs of spring, so she and another child were chosen to take care of the "Signs of Spring" bulletin board. Her twigs (labelled "Mildred found these buds"), and some of the bird pictures (with a sign stating that Dick saw the first robin) were the start of their board.

One afternoon soon after this we talked together about the signs of spring that other children had seen, and drew pictures showing these things. These were added to the Spring bulletin board.

Mildred began to add things the children brought in, as well as to draw continued interest to the board by asking questions on it such as 'Have you seen this bird?' 'Did you hear the thunder last night?' and 'Can you find the buds?'

And so their bulletin board grew and changed as it reflected the progress of spring and the discoveries of the children."

A Smelling Bee

This "interest center" by Margaret Barry consisted of a tray on which were ten small paper cups. Each was covered with a paper doily in which several small holes had been punched and which was held in place by a rubber band. Each cup contained a smellable sample of a familiar home material: coffee, vanilla, orange juice, onion, and others. A label invited viewers to a "smelling bee," directed attention to slips of paper for answers, and to a hidden an-

Built Around a Picture

Life magazine had just published the twelfth article in its series, "The World We Live In," entitled *The Varied Spectacle of Life in a Woodland Close to Home*. The double panel included in the article became the center of a two-phase display by Ruth Josephson and Paul Hafer. Because the available space was dark, color was indicated—to lend attractiveness and to attract attention. Tan and green were prominent in the picture, so tan was chosen for its background. Questions about the animals and their habits—answers were barred until later—were listed. Locations for question cards in the area around the picture were planned with due attention to attractive arrangement. Then chosen questions were written on alternate green and tan placards, and posted in the planned places with green strings indicating the part of the picture to which each referred. A shed snakeskin and a few nuts gnawed by squirrels, brought in for "show and tell," were available. Both were given a place on a shelf below the picture, which accommodated, also, a few books in which answers to some questions might be found.

A large sign invited research during free time, and promised that time next week would be devoted to checking answers and placing them on placards, so they, too, could be displayed. Preliminary suggestions about answers led to variety: some were drawings, serious or cartoon type; some were specimens, including rabbit browse and a borrowed plaster cast of an opossum track; some were books, opened at appropriate places; some were written statements. The "64-dollar" question brought out that while one might find all the animals pictured in woodlands, he was not likely to find many in one place, at one time.

Exhibits to Extend Horizons

A traveler in Mexico who had visited the area of the volcano Paracutin, had loaned to the class a large painting of the mountain, a piece of lava, a vial of sand, and a piece of Mexican pottery. Labelled *a new rock* and accompanied by an arrow that read, "From here" and indicated a spot in the picture, the lava opened the way to new learnings about rocks and rock formation, and about changes in the earth. The sand brought about discussions of weathering and soil formation, and the bit of pottery called attention to one use of earth materials.

A collector of arrow-heads loaned a part of his collection to a class studying Indian Life. It had become a science interest center. Not all the arrow-heads were fashioned from the same kind of stones: the Indians usually used what they found in the different places where they lived. What kinds of rock made good arrow-heads? The arrow-heads were not all of the

same size: were they used for different purposes? These and other questions came up and were answered by interested, eager searchers.

Can Color Help Animals?

The question "Can color help animals?" called attention to an exhibit (by Joyce Hiland) mounted in the two parts of a stocking box (below). Intended to stimulate the interest of primary grade children in small creatures, chiefly insects, it led also to some appreciation of the principle of protective coloration. In one box the following specimens were mounted on a white background: a green tiger beetle, honeybee, a colorful millepede, a lady beetle and another unidentified spotted beetle. In the other box, duplicate specimens were pinned against a background of dead leaves stems, stones and similar materials. The card near the first box asked, "Can you find these among the leaves?" An appropriate book invited further investigation.

How Animals Move

Living animals, appropriately caged in glass jars, served for a kindergarten group as a follow-up of several outdoor experiences, individual and group. The exhibit, reported by Nancy Egan, served to increase awareness of "many kinds of creatures and their own particular characteristics." Labels indicating method of locomotion were one word each: Fly (a bee and a fly); Walk (an ant); Crawl (an earthworm); Jump (a spring peeper); Swim (a goldfish).

Are animals protected by their color?

Praying mantis and her egg-case. Mantis egg-cases are straw-colored masses often an inch or more long. Laid in fall, on boards, weeds, or other support, they hatch in the following May or June. Each mass may contain hundreds of eggs.

Young mantes apparently are born hungry. If they do not find other food, they start to eat each other. Before this happened, we freed them from the open window. Because of their lightness the wind blew them away. I know how much I enjoyed this combined bulletin board and interest corner and I'm certain the students did, too.—*Carol Schuette*

Sea Creatures

The two exhibits shown on page 19 were done by Katherine Stevens and Nancy Kohler. Both were planned for primary-grade children. Particularly interesting are the challenging questions, the appropriate references, the recognition of contributors, the note of realism in the sand and well-worn pail, and the colored paper, cut to contour so that shells picked up can be easily returned to their places. The bottle at the center contains olive oil—"Dick's brother" gave the mounted shells a thin, well-rubbed coat of it. (The label at center front belongs in front of the easel.)

Skulls of Animals

A cow skull, discovered on a hike, stimulated this interest cor-

Animal Tracks in First Grade

The first grade had enjoyed finding and learning about animal tracks in the snow—at school and at home. So, writes Mary Kiernan, the teacher, "We made a big track chart and put it up in our room so the children could enjoy their work and also review the patterns of the different tracks. We did one animal track each day, starting with a child's own footprint. We used our pet rabbit, plus a dog and a cat that children brought to school for the occasion. We used thinned tempera paint in a cookie sheet, placed an animal's feet in this pan, then let him walk around on a large strip of mural paper." Each animal had its own color of paint and a record of each kind of track, in its own color was made on a sheet of drawing paper. Supplemented by children's drawings of the animals, these separate track records became a game, "Can you tell which animal made each track?"

Mrs. Kiernan adds: "If I do it again I believe I would prefer vegetable coloring (which she had seen used by someone else), would block off an area for each animal's tracks, and would use food to coax uncooperative animals along a straighter path."

A Praying Mantis Egg-Mass

My interest corner and bulletin board were developed in a junior-high-school science classroom and were concerned with the praying mantis. One of the boys had sent away for a praying mantis egg case, which he brought to school upon its arrival. We put the egg case in a large fish bowl and placed half an apple in with it because we had read that praying mantes would hatch soon if the case was kept in a humid atmosphere. We covered the bowl with very fine wire screening.

Students found pictures of the praying mantis in some old magazines along with quite a write up. We mounted these, together with our questions, on the bulletin board, with strings leading from the pictures and questions to the bowl containing the egg case. In answer to many of the questions asked, all we said was, "Watch," or "Wait and see."

Three other praying mantis egg cases were found after this first one had been brought into class. The students had never noticed them before, or if they had they hadn't known what they were. This interest corner was set up at the end of the third week in April. On May 6, the praying mantes hatched. We were all surprised—the praying mantes were not green like the adults but rather a straw color. But the young looked just like the adults except for their color, their small size, and the fact that their wings were not fully developed.

All the classes throughout the day watched the young come out.

teachers she included a vegetative stalk of common horsetail, thereby offering an opportunity to several persons to discover that the conspicuous green parts of this plant were branches, not leaves. This exhibit was its own demonstration that "easy does it" should sometimes determine the care given to labelling and arranging materials. The leaves soon wilted or dried and, by common consent, the exhibit was soon removed. Its greatest value lay in preparing it, not observing it.

Little Seeds That Grow

The table display shown on page 26, by Jeanne Smith, was planned for and used with three-year-olds. A colorful lining in the box, colored pictures of the vegetables, attractively mounted seed specimens, and an appropriate book all contributed to the development of a simple concept.

Elizabeth Ostrom developed the same concept differently through an indoor food garden in a florist's flat. Seeds of pea, radish, onion, carrot, and cucumber were planted and the rows marked by stakes connected by yarn to nearby specimens of the vegetables and their seeds, displayed against colorful backgrounds. Labels supplemented the display. Developments as the seeds germinated, the specimens of vegetables deteriorated, and plants grew (or didn't) maintained interest, provided for additional learning, and demanded progressive reorganization of the exhibit.

Colored pictures of winter buds, from an old magazine, gave the central idea of this exhibit, arranged on a blackboard and chalk tray. Glass vials contained specimens. Colored construction paper was used for the lettering, arrows, and mats.

ner, arranged by Betty S. Davidson, for use with young children. Miss Davidson writes: "Many young children have a rather hazy notion of how they and many familiar animals are put together. Some of them know that it is possible to break a bone in an accident. All of them know that the fish, chickens, and cows they eat in the form of meat have bones. They see dangling cardboard skeletons at Halloween and are familiar with the skull and cross-bones on the pirate's 'Jolly Roger.' Yet few of them have really clear ideas about the skeletons that they and all higher animals have within them. In order to help bring about this realization, I planned a display of animals and their skulls. The cow skull, on a bright purple mat, went on display accompanied by a black-crayoned, white, stand-up label: "This is the skull of a cow. What does a cow eat? Are the teeth biters or grinders?" When discussion had raised questions, a second section was added to the display: stuffed specimens (borrowed) of a chipmunk, a deer mouse, and a Norway rat, each accompanied by a specimen of its skull, all displayed on orange construction paper with a stand-up label: "Each of these skulls came from the animal by its side. Do all animals have skulls?" A big purple-bordered, stand-up sign, *Skulls of Animals*, called attention to the display, and presented a setting for many further learnings.

Leaves

Jana Mason planned this interest corner as a part of a unit on plants for second grade. Her purpose was to broaden concepts about leaves. She planned to lead up to it by discussions with the class, through observation and comparison of leaves they brought in, and by brief, schoolyard trips to observe leaves on various plants. (Note: Where poison ivy occurs, these preliminary experiences should include opportunity to learn to recognize it.) Then, when interest in differences among leaves had been aroused, everyone was to bring in, next day, as many different kinds of leaves as he could find. These were to be examined, admired, and finally grouped to bring out such concepts as: Leaves grow on trees, on shrubs, on low plants, on plants in water. They grow in different places on plants. They differ: some are called by special names such as needles, or grass blades; some are "one-piece" simple leaves; some are compound with several parts; some are waxy, some hairy, some prickly, some thick, some thin, some have distinct odors, and so on. Opportunity to examine, to touch, to smell, and perhaps to taste would accompany arrangement of the exhibit, and the making of suitable labels would emphasize learnings, permit some casual identifications, and raise questions. It is interesting that when Miss Mason presented this plan, with her exhibit, to a group of prospective

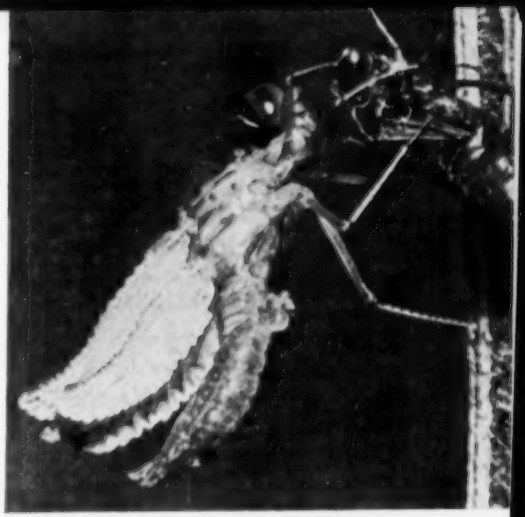
like journals, or diaries, or some other written record. Others prefer to sketch; or paint; take photographs; make plaster casts; make blueprints or other prints; construct models or dioramas; or assemble collections. Many excellent recorders combine two or more of these devices, or vary the type of record according to the materials or activities with which they are concerned. A field-trip record, for example, may include a written report of the date, the place visited, the weather, perhaps the time spent and the route followed, and the interesting or important findings, supplemented by sketches, photographs, plaster casts, or specimens.

But whatever the devices one uses, the learning that precedes the record, that accompanies its making, and that grows out of it, is the important thing. Without real learning, record-keeping can be merely busy-work.

Written Records

Men and women who observed and made written records of what they saw around them and what they thought about the things they observed have added greatly to our understanding of the world about us: Gilbert White, Henry David Thoreau, John Muir, John Burroughs, Olive Thorne Miller, Dallas Lore Sharp, and many others.

Gilbert White put his thoughts and observations in the form of letters; Thoreau wrote his journals in whatever notebooks the local stores could supply. These two and many others ultimately saw their records become books, enjoyed by many readers, who often were led, through them, to observations and thoughts of their own.



To watch a dragonfly emerge from its nymphal skin is an experience worth recording.

For elementary-school pupils neither extensive nor formal notes are necessary or advisable, but children can and should be encouraged to learn to meet one requirement of a good recorder: to write clearly and exactly what they have observed. Group records of science experiences may give this training as well as help children remember significant discoveries and important learnings.

Frequently children find in their science experiences a powerful stimulus to oral and written expression. A child who has seen a dragonfly emerge from its nymphal "skin"; has watched a dooryard bird build its nest and rear its

Fresh Coconut

This interest corner resulted from Ann Denton's vacation trip to Florida. Enough coconuts were displayed to show one complete with outer husk; one with half the husk removed (and left where it could be touched and the toughness of its fibers tested); one huskless coconut that could be shaken to make the milk inside "rattle," and examined to see the three spots from which the sprouts grow; one punctured (through one of the spots) so that the milk could be poured into a nearby jar and the nut opened to show the fresh meat. Labels invited observers to taste both the milk and the fresh meat as well as the shredded coconut in a nearby opened box. (A real problem was posed by the need to devise some means to taste with due regard to health teachings.) This exhibit was planned for second or third grade. Reference materials and questions as to further uses of coconuts, where and how they grow, and other items of interest would make it challenging to older students.

Keeping Records

RECORDING experiences and activities is an important part of a science program. Through records of various types, learnings may be organized, checked, clarified, reinforced, and put into form for future use. Good records are based on good observations, and are a powerful stimulus to careful observing, as well as an effective check on ability to "see" and to tell exactly what one has "seen" and done.

Well-kept records may transform day-by-day observations, discoveries, and accomplishments into data of use in building understandings, identifying and solving problems, forming judgments, developing attitudes, and intensifying interest in and appreciation of the world in which we live.

Records may take many forms; some are discussed in the following pages. They may be general or restricted to a particular topic or interest. Each type offers an opportunity to practice basic skills, to use special abilities, and to achieve the satisfaction of putting one's discoveries and accomplishments into concrete, more or less permanent form, for his own enjoyment or to share with his associates.

In school, records frequently are group projects, and the type and detail are agreed upon by group action. But individual records—whether of school or out-of-school science experiences—probably should be matters of individual preference. Some persons enjoy keeping long, detailed records; some keep practically none. Some

faction *is* important. The excerpts from a nature diary (pages 43 to 45) illustrate some of the satisfactions gained from a continued record of one creature. A record of close contact with some one object of observation is a good way to begin note-keeping. Many persons, once initiated, find that they enjoy not only the recording, but the increased awareness it brings, the stimulus to further learning, and the opportunity to re-live experiences, to reinforce memory, and to make comparisons from time to time or from place to place. But often keeping notes is like taking music lessons—a bit of urging is necessary at the start, but when early efforts begin to yield satisfaction, the activity becomes self-maintaining.

Notebooks also offer a way to share experiences. Two middle-grade children kept a notebook record of a trip to Florida, and both they and other members of their class enjoyed having parts of it read aloud in school. A fifth grade, tired of oral reports, wrote diary-type records of interesting science experiences, which they pinned to the bulletin board for others to read.

A science notebook may be of any size, type, or shape; or the record may take the form of a card file, a permanent, expansible record, arranged by topic, so that information may be easily located and additions or corrections readily made. Written notes often are embellished by sketches, photographs, mounted specimens, or other forms of record.

A Month with Albert, the Wood Snail

This series of observations and experiences was excerpted from a nature diary kept by Mrs. Anna G. Sibley.

April 24 (Sunday). Friends brought to me a wood snail with a spotted shell—for my terrarium. What a fascinating creature! I watched his eye stalks extend to great length as he immediately began to explore his new environment; I noticed the short feelers under the eye stalks.

April 25. Today my snail, Albert (named by a friend), is attached to the side of the terrarium. He has left a serpentine mass of dark excreta behind him as he inched along. Also visible are trails of mucus-like secretions over the soil—from his foot. Later I think I caught Albert munching on a leaf of a plant in the terrarium. He drew in his eye stalks and feelers as I lifted the cover. But soon out they came again to explore along the glass cover. Waves of motion are observable in his stomach-foot as he moves; also a liquid pulse under his shell.

April 26. Albert has an appetite! He has already eaten two leaves of my terrarium plant.

April 27. Albert had a fine time crawling over my hand. It was

young; has made a model electric motor that "works"; has watched a rain-born rivulet wear a miniature channel in a schoolyard slope has, in Dean Bailey's words, "the very first essential . . . something from one's own experience to say."

First Records

First-graders often compose little "stories" or "poems," which their teacher transfers to the blackboard, to a large reading chart, or to what becomes a page in the child's own notebook. Such "science experience stories" may provide an easy entry into reading, and a satisfying way to enjoy the written experiences of others. Here are two sample pages from a first-grade notebook:

A Salamander Story

We have two red-backed salamanders.
When David caught the little one, its tail came off.
But it will grow a new tail without bones.
Salamanders eat ants and other insects.
They live on land in moist places.
They look like tiny crocodiles.

A Snail Story

Their eyes are on little stalks.
They can pull in their eyes.
Snails can look over things with their eyes.
The snail's house is a shell.
Some live on land and some live in water.
They put out slime to slide on.

And here is a "poem," the making of which another first grade thoroughly enjoyed, especially when the teacher contributed her line, "I have no doubt," following a long, concerted search for a rhyme for "out:"

Our Snail

Snail, snail,
Tell me a tale
Of how you made
That messy trail.

And how do you poke
Your eyes way out,
To see much better
I have no doubt?

How do you make
That curly shell?
Please, please, snail,
I wish you'd tell.

Other elementary-grade children may specialize in schoolroom "newspapers," or "Science News Bulletins," which tell of their discoveries, plans, and activities. Child-made booklets about flowers, or birds, or rocks, or toys, are another familiar way to record science learnings—but unless they are a real, vital part of a learning situation, they, too, are practically valueless and may be completely boring.

Diaries, Journals, and Other Notes

Whether one calls his science notebook a diary, a journal, a log, or just a science notebook is unimportant; whether his record covers a broad range, or is concerned with only one field of science such as birds, or even with only one object, is unimportant, too; but what he gains from it in increased understanding, useful information, improved skills, and personal satis-

cups, each set in the one below. This is 2:00 p.m.

5:05, and Albert is still laying eggs; quite a mass now. They seem to issue from near the head.

May 2. Albert has left his eggs, and is back to normal again, eating carrot.

May 3. About the experiment with Albert and the carrot: the excreta *is* orange. Evidently Albert does not change pigment to a great extent in his body.

May 8. I put a fly into the terrarium. Albert has burrowed down alongside the front glass. He is laying *more* eggs.

Albert has laid still more eggs. Are they fertilized, I wonder? It would seem a shame not to have them hatch. The others laid earlier have not changed yet.

May 9. I noticed that Albert was quite careful about covering his egg dugouts with soil.

May 18. There is no real change in my snail's eggs in the terrarium. One of the water snails in my aquarium has laid eggs on the shell of a larger one.

May 23. Some of Albert's eggs seem to be developing. They are a light brown and appear to have the first turn of a hard shell. They haven't moved from where they were laid. (These are the first group of eggs.)

Later: Albert's eggs must be hatching! One of his offspring has ventured up almost to the surface level of the soil.

I find that Albert's eggs came from a genital pore behind the right feeler.

Note: By the time school closed "Albert's offspring" had hatched in sufficient numbers and grown enough so that one could be presented to each second-grader, to be taken home for a pet.

Calendars

Nature calendars are records of series of observations, presented in some organized form. They are a familiar way to record changes or passing events. Often they are designed as group projects, and are large calendars, ruled on a blackboard or a card, with space to write or draw a daily record. Or, they are charts, with columns for agreed-upon data. They may also be individual undertakings, using a notebook page, or a calendar. A first-grade teacher told of buying small, inexpensive calendar pads, gummed on the back. Each child glued a pad to a corner of his desk, and kept his own record, delightedly drawing something tiny for each day.

Keeping a calendar is valuable not so much for the facts discovered and recorded as for the careful observation the activity stimulates, the broader interests it awakens, and the increased awareness of change it arouses. Calendars that record natural phenomena, if interpreted as they should be, are bound to develop some ap-

interesting to watch his eyes recoil at the slightest contact with anything, bouncing into his head and out again like a yoyo. He left a slimy trail over my hand. As he crawled off the edge and swung around underneath, only part of his foot touched my hand—amazing adhesion, and supporting the awkward shell too! He would inch forward, seeming to forget his shell which would flop over sideward. Then with a heave, he would pull it forward again to rest above his back.

April 29. Albert is all curled up today, and two more leaves are missing. The terrarium is getting messy. I have noticed that not so much moisture collects on the top and sides of the glass. Albert requires it, I guess.

I tested a remark from Mrs. Comstock's *Handbook of Nature Study* that when you hold a snail upside down, it must come out to see why it is in this position. It seems to be true. Mrs. Shuttlesworth says, in *Exploring Nature With Your Child*, that snails require little food, thriving on cabbage or lettuce leaves, carrot pulp, and similar foods. It is interesting to watch Albert curl up into his shell. His head pops in first; then his foot, which is folded lengthwise, is drawn in—sometimes so far that only the tip is visible through the mucous covering.

I placed unresponsive Albert on some lettuce; he responded nicely. I can hear the crunch as he chews. (I worried about calling him "he" until I found out that both sexes are in this one animal.) He certainly eats quickly—plows right through. He must have been hungry. I watered the terrarium a little, for fear he would dry out.

April 30. Albert's food literally goes in one end and out the other. Now the excreta is a vivid green—the influence of lettuce, I guess, and is plentifully distributed throughout the terrarium. The small excretory hole (anus) is on the right side near the edge of the shell.

May 1. I could not find Albert. I looked and looked and finally found him behind the bracket fungus which I had stuck in front of the back glass and in some moss. I pulled him up but he came with some difficulty. He had a clear white "egg" stuck to him near his mouth. Apologizing, I stuck him back for I realized from what Dr. Gordon had said that he-she must be laying eggs. When I later looked in through the back of the terrarium, he was extended his full length in the hole he had burrowed, leaving his shell above—still attached of course. He was moving his head slowly back and forth. This is exciting!

I shredded some carrot into the terrarium and wondered if the excreta would be orange. Albert is too busy to eat now, though.

Since I last saw him with his one egg (about 11:00 a.m.) Albert has laid four more eggs in a chain of

method of showing these facts, using the information from a weather calendar, is illustrated on this page. Understanding weather forecasting and first steps in making forecasts lead naturally from such summaries.

A way to correlate pairs of weather factors:

Wind	Sky			
	Cloudy		Clear	
Easterly (E, NE, SE)	//////	6	//	2
Westerly (W, NW, SW)	///	3	//// ////	8

Cloudy sky and easterly winds commonly occur together; clear sky and westerly winds.

Temperature	Sky			
	Cloudy		Clear	
Warmer				
Cooler				

Temperatures usually rise when the sky becomes cloudy and fall when it clears.

Pressure	Sky			
	Cloudy		Clear	
Higher				
Lower				

Lower air pressure usually accompanies a change from clear to cloudy skies.

Seasonal Changes

For little children, calendars of seasonal changes mark successive "Signs of Autumn," of winter or of spring, and record the changing activities of plants and animals, characteristic weather events, their own concessions to change, and similar factors. Older children may correlate such observations with a record of the changes in the number of daylight hours and in the height of the sun in the sky. *Sky Laboratories*, the Leaflet for Winter 1952-53, contained suggestions for such studies, and related observations have been suggested in many past Leaflets.

Moon Phases and Time Schedules

The regular recurrence of changes in the visible shape of the moon and in its times of rising and setting are desirable understandings to be developed. *Sky Laboratories* dealt, also, with this type of record-keeping.

Bird Calendars

Columns in which to record the name of the bird, the date, where it was seen, and by whom are the essentials of such calendars. They lend themselves readily to decoration, and to special features such as one or more places to display pictures of "new birds today," and extra columns in which to tell how each bird was recognized, to list second reports, or to enter comments. Similar calendars can be

preciation of the interdependence of living things and of their dependence on the changing conditions of their environment. They offer, also, opportunities to make comparisons, and to draw conclusions from information. Some types are discussed in the following paragraphs, but many others, of broad or narrow scope, will suggest themselves to teachers.

Weather Calendars

Weather calendars are perhaps as common as any type. In the lower grades, they are usually group projects. A calendar form is used, and only general conditions are recorded: wind and calm (little children first notice the presence of wind, later observe that wind has direction); sun and cloud; wet and dry; heat and cold. These conditions they may indicate by cut-out figures, colored discs, or descriptive words. When they become aware of wind direction, they may record it by an arrow flying with the wind, considering the top of their record north. (To do this implies a basic knowledge of directions. If, when it is marked, the record can be placed on a table or desk so that its top is toward the north, orientation is simplified for the children.) Measurement of weather factors such as temperature, wind velocity, and precipitation, follows in later grades as children develop the necessary skills. Older children can include air pressure (best read from a barometer), and can use either a calendar form or a chart, such as one with the following columns: *Date, Time* (same each day), *Temperature, Pressure, Sky Condition, Precipitation, Changes, Interesting Happenings.*

The whole point of recording weather conditions, however, is to make children conscious of weather phenomena, and, then, of the relationships between weather factors. So, even little children should summarize their records at the end of a month or some other convenient period, and should make simple comparisons of records for different periods. They should note such items as the number of clear days and cloudy days, wet days and dry days, warm days and cold days, how many days of one type followed one another, and, when they can, the corresponding facts about wind direction. Older children can discover, from their calendars, whether the winds they record *are* prevailingly westerly, what weather signs and sayings seem to be supported by their records, and what weather conditions usually are associated with each other. Out of their summaries and comparisons should come some recognition of the periodic alternation between cooler, clear weather with high pressure and westerly winds, and warmer, cloudy weather, with low pressure and easterly winds, that is so characteristic of New York State weather. A tried

many kinds of mammals may be collected only by permit and strictly for scientific purposes; conservation regulations govern the collection of many other animals and of plants of protected species or from private or protected lands. *Woodlands in Spring,* the Leaflet for Spring 1954, outlined state regulations regarding plants). In a science center children may learn what and how to collect and how to preserve specimens; how to arrange and care for collections; and how to use them as a means of learning.

Group collections often provide useful materials for study, and are not subject to many of the objections that apply to extensive individual collections. With wise use, either group or individual collections can enrich a schoolroom science program and offer opportunities for individual undertakings in the science center. They are of value chiefly as records of science experiences and the means of further learning. An insect collection that grew up in Lillian Bell's third-and-fourth-grade classroom is an illustration.

"It all began," writes Miss Bell, "when Jimmy's yellow jacket came to school in a jar. As the boy displayed his specimen, some of the children insisted that his yellow jacket was a bumblebee. Out came the reference book—it *was* a bumblebee. Jimmy scored a victory, however, by discovering that yellow jackets, hornets, honeybees, and bumblebees belonged to one group. The word *Hymenoptera* came into use.

The third-and-fourth-grade class arranged their insect collection in an unused display cabinet.

"From then on reference books were in steady demand. Dozens of insects came into our room, in jars, on plates, in boxes, in fists. Some were found in garages, some in homes, and many on the way to school. We did our best to identify them, but some were puzzles. Coleoptera and other entomological terms began to roll off tongues. The children decided to mount their insects for other classes to see. We had a large, glass-doored display case for our class collection. Colorful pictures from *Life* magazine became background decorations. Each child mounted his own insect (or insects) individually in

devised to record insect activities or the spring return of amphibians.

Flower Calendars

One of the chief values of these records is to stimulate acquaintance, but keeping a record (date, name of flower, where it was seen, its discoverer) can provide a setting for consideration of conservation problems. If interest is directed to such groups as garden flowers, woodland flowers of spring, October flowers, May flowers, and other specific groups, the records will contribute to such concepts as plant associations, seasonal succession, and perhaps plant relationships.

Tree Calendars

In autumn, these records probably emphasize chiefly leaf coloration and fall. In the spring, they may be concerned with such information as when buds open, when blossoms appear, and when the first "flat" leaves are evident. The growth rate of a single leaf is a fascinating thing to watch.

Suggestions About Calendars

A multiplicity of calendar records at one time is confusing unless individuals or groups specialize on chosen subjects. One or two "whole-group" records at a time are enough, especially with young children. Make records mean something through interpreting or comparing the data collected. Too often keeping them becomes a routine chore and little more.

Collections

Most children like to collect; so do most adults. Often, what to do at school about children's collections (and collecting propensities) is a problem. Properly directed, the collecting spirit should probably be encouraged. When it involves local objects or specimens, it brings the collector into contact with his materials in their natural setting and furnishes him with one way to obtain further information and to develop new learnings. But when and how much the science teacher should encourage the collecting habit must be determined for each separate case. One should collect in order to learn and to share learnings with others. Especially when dealing with living things the collector should have an acceptable purpose beyond the mere amassing of specimens. Years ago, Dean Bailey wrote: "Children should be interested more in seeing things live and in studying their habits than in killing them." That suggestion still holds good.

As a part of their science training, children should be guided to make collections of real value (if they collect); to learn and respect regulations regarding the collection of specific things; and to govern their collecting activities according to conservation demands. (Birds, birds' eggs, and

may be employed with other types of specimens.

Rocks, Minerals, and Fossils

Cards of uniform size to which specimens can be fastened with household cement and which can serve also as labels make quick, inexpensive, easily stored mounts.

Egg cartons are good receptacles for collections of small specimens. Numbered labels can be pasted in the compartments and corresponding numbers on squares of adhesive tape affixed to the specimens.

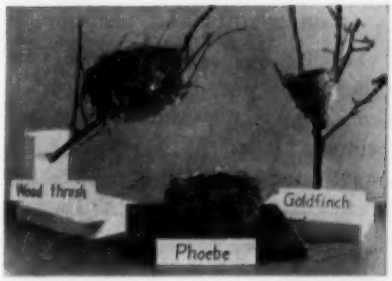
Shells

Rubbed lightly with oil (olive oil or salad oil, for example), shells cemented to the bottom of a cardboard box of suitable depth make attractive collections. Labels can be lettered on the bottom of the box or on small slips of paper, glued in place.

Insects

Live insects in cages are much more interesting than dead ones, but mounted insects often are useful. A candy box, lined with two layers of corrugated board, covered with white or colored paper, holds a number of pinned insects. Transparent plastic boxes, similarly lined—to hold the pins—are useful, too.

Small vials or bottles make good containers for jug-builder wasp "nests," cicada or dragonfly skins, and similar specimens.



Birds' nests are best collected in fall, after they have been abandoned.

Plant Specimens

Dry tops of such plants as teasel, dock, and cat-tail can double as study specimens and as winter bouquets if attractively labelled and arranged.

Small seeds and fruits are easily displayed in medicinal gelatin capsules, cemented to cards on which needed information has been lettered.

Signs of Animals

Animal-gnawed stems, nuts, and fruits; shed snake-skins; deserted bird's nests; feathers; skulls; and other signs of past or present animals can be arranged as an interest center, or cemented to a display card, accompanied by either informative or questioning labels.

Many things come from a rock.

the top or the bottom of a small box (chiefly jewelry boxes), lined with colored construction paper, and furnished with a lump of plasticine to hold the pinned insect.

"We had questions; and many of the children wanted to use these 'firsts' as a basis for collections of their own. So we called on a Cornell entomologist for help and ideas. He came to our class, bringing colorful slides and some live insects, and gave us an interesting talk. He showed us cigar-box collections, with two layers of corrugated cardboard to hold the pins, and left them for closer examination.

"Our display grew. Spiders and other creatures not insects came in, and we decided that it was best not to call our collection an insect display when other children came to look at it, and to explain why the specimens were not all insects. When the exhibit was finally dismantled, all the specimens were taken home, some to become the nucleus of individual collections."

About Names and Labels

A name is like an introduction—it is good beginning for further acquaintance. It also makes talking about an object or a specimen easier. But a name is not indispensable. Neither teachers nor children should fail to look for interesting things about a science object merely because they cannot name it. It is much better to leave something unnamed, or to give it a tentative title, than to mislabel it.

Labels, with or without identifying names, are important. Ordinarily they should tell what the specimen is, where it was collected and by whom, the date of collection and any additional pertinent information. And they should be firmly fastened to the specimens.

Types of Collections

Collections that are specific in nature are probably most useful in the elementary school. Examples are: the weeds of the schoolyard; insects from our garden; galls from a woodland; dwellers in a rotting log; ways seeds are scattered; flowers from an open field; tree fruits and seeds; fruits birds eat; insects of value to man; leaves, flowers, fruits, and twigs of schoolyard trees; common ferns; rocks of our neighborhood.

Arranging Collections

Ways to make, organize, arrange, record, and house collections are numerous, and vary with the kind of collection. Some of the references listed on pages 60 and 61 give detailed descriptions of many methods. They or similar helps should be consulted for general directions for the usual types of collections, such as rocks and minerals, insects, and pressed plants or plant parts. A few examples of small, more or less temporary, collections of some common objects are given here. The methods used

Leaf Prints and Others

Making leaf prints or prints of other science materials is not essentially a science activity. But leaf printing, properly used, provides an effective setting for science experiences. The processes involve acquaintance with a variety of materials and techniques and provide permanent, easily kept records that lend themselves to exhibit and other uses. As records, prints should be labelled like any other specimen. Identification should be made, if it is to be made at all, before the print is made, certainly before the object is discarded.

For many children, leaf printing is fun. It is something to do, and they can produce attractive results. They can apply what they have learned to Christmas cards, decorated stationery, notebook covers, and other things. But, if learning is overlooked in the fascination of the process, leaf-printing makes little or no contribution to a science program.

Prints are so frequently made of leaves only that they are often known as *leaf prints.* But sprays of leaves, certain flowers, fern fronds, and even whole plants can be used. Grasses make particularly good subjects. Leaf prints are a good starting point, however, and are the subjects of the following directions. Fresh leaves may be used; fresh leaves which have been pressed for a few hours are better; dry pressed leaves will serve if placed under a weight between damp papers for several hours. The procedures outlined are not the only ways to make the prints described. Most persons develop their own variations in materials and ways of working, as references listed on pages 60 and 61, and others, show.

Crayon Prints

Crayon prints are perhaps the simplest to make, and both the outline and the vein pattern of the leaf emerge. The finished print may be kept as it was made, or the leaf may be cut out and mounted. It is desirable to match the natural leaf colors as nearly as possible.

Materials: wax crayons; thin white paper.

Procedure: Place a leaf, veiny side up, on a flat, hard surface. Lay a piece of thin paper over the leaf. Hold the paper firmly in place and rub the crayon over the entire leaf. Use parallel strokes, make the strokes overlap, and see that the whole leaf margin is brought out clearly.

Stamp-pad Prints

Stamp-pad prints, too, show both the outline and the vein pattern of the leaf. They are easy to make, and can be made "on the spot," since the materials are easy to carry.

Materials: Inked stamp-pads

(various sizes and colors are available); newspaper, cut to approximately the size of the pad; tweezers, if desired; notebook sheets, writing paper, or construction paper.

Procedure: Place a leaf of suitable size, veiny side down, on the pad, and cover it with a piece of newspaper. Carefully rub your fingers over the newspaper, above the leaf. Be sure to press the whole leaf, including the petiole against the pad to insure an even coating of ink. Remove the newspaper, and, using the tweezers, place the leaf, inked side down, on the print paper. Cover it with clean newspaper, and, holding all firmly in place, rub carefully over the leaf. Remove the newspaper and the leaf, and allow the print to dry.

Carbon-paper Prints

Carbon-paper prints are similar to stamp-pad prints, and equally easy to make.

Materials: Sheet of carbon paper; smooth, white paper for prints; newspaper; a flatiron; tweezers, if desired.

Procedure: Place a sheet of carbon paper, carbon side up, on several thicknesses of newspaper. Lay a leaf, veiny side down, on the carbon paper. Cover the leaf with newspaper, and press it with a warm flatiron. Transfer the leaf to the print paper, placing it carbon side down. Cover with clean newspaper, and press again.

An ink print of a basswood leaf

Ink Prints

Ink prints are highly satisfactory: they are relatively simple to make; they reproduce the outline, the vein pattern, and something of the texture of the subject printed; and, once thoroughly dry, are a long-lasting record.

Materials: Linoleum block-printing ink (available in black, green, or brown, in water-soluble or oil-base form—the oil-base form is a good choice); or printer's ink (highly satisfactory, but not so easy to remove from equipment—or clothing); a pane of glass; newspaper; a rubber roller or brayer, or some substitute for it; tweezers; soft-textured paper, such as mimeograph, poster, or construction paper

for prints. Turpentine or kerosene can be used to thin printer's ink or to remove it from utensils. Application of any grease, followed after an hour or two, by washing with mild soap and cold water usually removes printer's ink from clothing.

Procedure: Squeeze about ½ inch of ink onto the glass plate. Practice will show how much ink is necessary to produce clear, unsmudged prints. With the roller, spread the ink evenly over the glass, covering a surface large enough for the leaves you wish to print. Place a leaf (veiny side down usually is best) on the inked surface, and cover it with newspaper. Run the roller, or rub your fingers over the entire leaf, especially along the midvein. Remove the newspaper. With tweezers, place the leaf, inked side down, on the print paper, and cover it with clean newspaper. Then, being careful not to let the leaf slip, rub your fingers over the newspaper above the leaf. Be sure to press the entire leaf firmly against the print paper. Then remove newspaper and leaf, and allow the print to dry. The procedure may be varied by inking both sides of the leaf (by placing it on the glass and rolling it, uncovered, with the inky roller). Then place the leaf on one half of a folded piece of paper, fold the other half over it, cover the paper with newspaper, and rub gently but firmly over the leaf. The prints of the two sides of some leaves show interesting differences.

Smoke Prints

Well done smoke prints reproduce the outline, the vein pattern, and something of the texture of their subjects. They are somewhat more difficult to make successfully than other prints, but excel all the others in delicacy.

Materials: Soft-finished cardboard (cereal boxes, shoe boxes, and tablet backs are good sources); a candle; matches; vaseline; tweezers, if desired; newspaper; smooth, soft-textured paper for prints, such as mimeograph, poster, or construction paper.

Procedure: Spread a thin, smooth coat of vaseline on the cardboard. Move the greased side of the card slowly back and forth through the yellow portion of the candle flame until it has a *heavy*, black coating. This requires several minutes and watchful care to see that no part of the card becomes heated enough to burn. Practice will show how to hold the card to get the most smoke and when there is enough soot to use. When the card is ready, lay it, smoky side up, on a flat surface. Place the leaf, veiny side down, on it. Cover both with newspaper, and rub gently until an even coating of soot covers the underside of the leaf. Then transfer the leaf, with tweezers, to the printing paper. Place it sooty side down, cover it with newspaper, and, holding everything firmly in place, rub gently over the whole leaf with the finger tips. When you remove the

paper and the leaf, you should have a sharp, delicate print. Usually, if dried thoroughly, these prints do not easily smear. But they may be sprayed with a plastic or other fixative spray, if desired.

Spatter Prints

Even carefully made spatter prints show only the arrangement and outlines of their subjects. But they are attractive, fun to make, and require only simple materials. They can be a pleasant part of science learning and attractive reminders of worthwhile experiences.

The directions below are only one way to make them. It is easy to find suggestions of other ways and of other materials to use.

Material: Thinned show card colors, poster paints, water colors—almost any thin, colored liquid; flat containers to hold the colors (small ice cream cups serve well); corrugated cardboard or other similar material; pins, small stones, or other small things usable as weights; pieces of window screen (4-inch squares are a good size); discarded toothbrushes; paper for prints.

Procedure: Leaves to be printed must lie flat so that outlines of the print will be clear and sharp. Place the paper on which the print is to be made on a base, such as a piece of corrugated cardboard, and put the leaf in position on it. Hold the leaf margin close to the paper with pins (which leave holes in the finished print), or with small, carefully placed weights such as stones or nails. Dip the toothbrush bristles into the chosen color, shake off the excess liquid (to prevent "blobs"), then rub the bristles across a piece of screen, held a short distance above the leaf. (The closer the screen, the larger the "spatters" of color.) Rubbing the screen only *away from* the printer seems to reduce the danger of spattering him. When the desired intensity of color has been achieved, allow the print to dry undisturbed. More than one color may be used, either to spatter different areas, or for additional coats over the same area. One color must be allowed to dry before another is applied.

Stamp-pad, carbon paper, ink, or smoke prints with spatter print backgrounds make attractive booklet covers and other things. Spatter the paper on which one of these prints has been made before you remove the leaf.

Blue Prints and Others

Directions for making blue prints, driprints, ozalid prints, or photographic prints, all of which require special materials and involve special procedures, are purposely omitted from this Leaflet. Descriptions of materials and processes are available, in some of the references listed on pages 60 and 61 or in other books.

Mushroom Spore Prints

It is difficult sometimes for children to appreciate the smallness and the vast numbers of spores produced by some of the spore-bearers. A mushroom spore print may be of help.

Cut off the stem of a mature, fully opened gilled mushroom, where it is attached to the cap. Place the cap, gill side down, on a piece of paper—medium blue is a good color. Cover the mushroom with a turned-over glass dish to exclude drafts. Leave it undisturbed for 24 hours, then carefully lift up the cap. Spores falling from the gills should have made a delicate pattern on the paper. If they have, allow the print to dry in the air. If not, try again—success does not always come the first time.

Usually spore prints made as described last fairly well. But to make more permanent prints, the paper may be coated with a very thin mucilage-water mixture before the mushroom is put in place, and the print may be further fixed with an ordinary fixative spray.

Spores of different kinds of mushrooms range in color from white, through pink and rusty brown, to black.

Plaster Casts

"Track casting is one of the best and easiest means of keeping track —literally—of the animals in a certain territory." So writes William Hillcourt, in his *Fieldbook of Nature Activities.*

The first step in making such a record is to encircle a track in mud or snow with a cardboard or metal collar 1 or 2 inches high. Strips of material held together by paper clips work well. Press the collar into the snow or mud just far enough to hold it. Then put about a third as much cold water as you think would nearly fill the collar into a can or other container. Sprinkle in plaster of paris or the much less expensive moulding or gauging plaster available from a builder's supply house. Continue to add plaster, *without stirring,* until small peaks begin to rise above the water. You will need nearly twice as much plaster as you had water. Stir the mixture gently, to prevent air bubbles, until it is smooth. It should be about as thick as pancake batter or heavy cream—not too thick to flow easily, but not watery. If it is too thin, add a little plaster. Strike the container against the ground to make air bubbles rise and break. If you leave them in the plaster, they are almost certain to settle in a critical part of the cast. Then pour the plaster into the collar in such a way that it flows, not drops, into the track. Continue to pour until you have a cast thick enough to withstand handling—about ¾ of an inch. If you must clean your mixing dish so it can be reused, do it at once before the remaining plaster hardens. Wiping it out with newspaper is easy, and the paper can then be discarded. (Don't take it to a sink to wash

From William Hillcourt, Boy Scouts of America

Left, framing a track in mud; Right, pouring the plaster

it—the plaster may clog the plumbing. Use only perfectly dry utensils to measure or to hold dry plaster. Moisture causes small, hard lumps.)

After about half an hour the cast should have hardened enough to be picked up, together with the dirt or snow that clings to it. It may be brushed or washed clean when it has dried thoroughly.

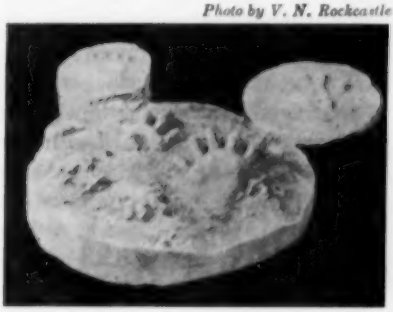
The cast you have made is known as a *negative*—the footprint shows as an elevation. It is a perfectly usable track record, but you can make a positive, with the footprint a depression, if you wish. Grease the negative, encircle it with a collar high enough to hold a second, equally thick layer of plaster. Mix plaster as before, pour it into the collar, let it harden, then separate the two casts. This may be difficult or impossible if the original track was deeply undercut.

To become a specialist in plaster-casting, there is much more to learn, but books that can give further help are relatively easy to find.

A record—name of track, place, date, name of recorder—can be "scratched in" before the plaster has thoroughly hardened. Right, a negative cast of a raccoon track.

From William Hillcourt

Photo by V. N. Rockcastle



Special Features for Science Centers

A "Do You Know?" Corner

An oblong of beaver board about 14 by 18 inches (the exact size is not important), hung on a wall, proved a successful "Do You Know?" center. Across the lower edge, a shelf about 3 inches wide was mounted. Objects of various kinds were displayed on the shelf or fastened to the upright space. Sometimes these objects were accompanied by bits of interesting information contributed by their owners; sometimes by questions to stimulate research. Often the shelf bore a new book or some other useful material.

For example: an improvised vase contained a St. Patrick's Day carnation, with the question (pinned above it) "Can you explain this?" Above a glass bottle that held the shed skin of a cicada nymph was a sign that read, "John found this on a tree. Does anyone know what it is?" A picture of a moonlit night was accompanied by a sign inquiring, "Why is moonlight really sunlight?"

A Conservation Corner

Conservation of natural resources is receiving increasing attention in classroom studies at all levels. Although not exclusively a science subject, much good conservation teaching can be done in connection with science studies. In the classroom conservation corner may be displayed pictures and articles; demonstrations illustrating such problems as soil erosion; models showing good conservation practices, and other appropriate materials. The conservation corner may perhaps occupy an especially prominent place during the spring months when Arbor Days, Birds Days, and Conservation Weeks claim attention, but it should be a permanent feature of the center.

An Occupation Center

An occupation center is a place to do things. It may be a permanent feature centered about a table or a shelf or other work space. It may offer occupations closely related to current units of study, or optional activities. Some possibilities are an electric bird-namer; a box containing several dry cells, some wire, an electric bell, some lamps, and other electrical equipment, awaiting interested experimenters (a popular feature of one fifth-grade room); the apparatus for an experiment performed in class, set up ready for pupils who wish to try it for themselves; a magnetic game; a deserted bird's nest, with an invitation to take it apart and display in paper plates the different kinds of materials the bird used; a how-to-make exhibit, featuring a display of equipment and steps in making a leaf print; or some living thing to watch.

A Reference Shelf and Reading Center

The science center should include a place for books, pamphlets, and other printed materials, such as science books from the room library; books on loan from home, or school, or public libraries; general reference books; science textbooks for several grade levels; and bulletins on appropriate subjects. Both pupils and teacher can frequently contribute pictures or clippings of interest. Pictures usable in many science studies, many of them in color, appear in magazines, in feature articles, and in advertisements. Those valuable enough to be saved may be turned over to an Editing Committee, to be filed by subject, in an expansion or other file, or mounted in scrapbooks. A Loan Committee may be responsible for borrowed materials. A place to collect discarded magazines and similar sources of pictures and other usable materials may provide worthwhile, leisure-time occupations for children who enjoy looking for and filing materials they can use.

Viewed broadly, such a reading center offers the opportunity to practice reading techniques: looking up information; learning to scan, to organize, to compare information, and to prepare it for use, as a report, for labels, for records, or for other specific purposes.

The Classroom Museum

In a schoolroom with an active science center, there is little need for what is sometimes called a classroom nature or science museum. Or, perhaps the science center is almost a museum in the modern sense of the word—a place where interested, active pupils may work with and learn about materials and forces of science that are of immediate significance to them; where they can increase their acquaintance with the world in which they live; and where they can learn to understand and appreciate the interrelationships between themselves (and other peoples) and their environment.

For those comparatively few materials that have lasting or recurring usefulness or are difficult to replace, the best answer usually is storage, where they can be kept in good condition, to be drawn into active service as they are needed. Often such things can be mounted in boxes, bottles, or other containers that effectively protect them from dust, dirt, and breakage. Child "curators" often can help pack, label, and care for such things. Occasionally an unused display cabinet, with glass doors that can be locked, can be pressed into service, either in the room or in a corridor, to keep objects, specimens, or other materials whose educational worth, interest value, or attractiveness justify permanent display. "Curators" can take charge of this, too.

Some Useful References

General Helps

Past issues of the *Cornell Rural School Leaflet* contain many suggestions and much useful information. A list of those still available may be had from the *Cornell Rural School Leaflet,* Cornell University, Ithaca, New York. Files are in many schools and libraries.

Elementary Science Textbooks. For children, these are sources of information and of suggestions for activities. The excellent illustrations in most of them are especially valuable. Books of several grade levels will enable readers of varying proficiency to find helpful materials. Sample workbooks that can be taken apart and used as the children wish are useful, too.

Elementary School Science Bulletins. Issues 1-17, May 1952 to April 1955. Published by the National Science Teachers Association, 1201 Sixteenth St., N.W., Washington 6, D.C. Many appropriate suggestions.

Making and Using Classroom Science Materials in the Elementary School. By Glenn O. Blough and Marjorie H. Campbell. Dryden Press, New York City. 1954. 229 pages. Helpful in many ways, especially in physical science studies.

Natural Science Through the Seasons. By J. A. Partridge. The Macmillan Company of Canada, Toronto, Canada. 1944. 520 pages. Many appropriate teaching suggestions.

Source Book of Science Experiences for Elementary School Children. Louisville Public Schools; address Mr. Eddie Belcher, 506 West Hill Street, Louisville 8, Kentucky. 1954. Two volumes, 305 pages and 195 pages, are for use at the primary level, and three volumes, totalling 990 pages, at the intermediate level. Much helpful material.

School Facilities for Science Instruction. Edited by John S. Richardson, National Science Teachers Association, 1201 Sixteenth St., N. W., Washington 6, D.C. 1954. 226 pages. Contains a chapter on facilities for teaching elementary-school science.

Books for teachers of elementary-school science (reviewed in previous Rural School Leaflets): *Elementary-School Science and How to Teach It,* Glenn O. Blough and A. J. Huggett, Dryden Press, New York City, 1951, 532 pages; *Science for the Elementary-School Teacher,* Gerald S. Craig, Ginn and Company, New York City, 1947, 561 pages; *Science for Today's Children, The National Elementary School Principal,* Thirty-second Yearbook Number, National Education Association, 1201 Sixteenth Street, N.W., Washington 6, D.C., 1953, 311 pages; *Science in the Elementary School,* W. C. Croxton,

McGraw-Hill Book Company, New York City, 1937, 454 pages; *Teaching Science in the Elementary School*, R. Will Burnett, Rinehart and Company, New York City, 1953, 541 pages; *Exploring Nature With Your Child*, Dorothy E. Shuttlesworth, Greystone Press, New York City, 1952, 448 pages.

About Displays and Collections

Much material of value to the teacher of elementary science is available in books that deal with the general subject of sensory aids for teaching. Only two books of this group are listed here, but there are many others.

Audio-Visual Methods in Teaching. By Edgar Dale. The Dryden Press, New York City. 1954. 534 pages. A helpful reference for the guidance of teachers.

Display for Learning. By Marjorie East. The Dryden Press, New York City. 1952. 306 pages. An attractive book on the production and use of visual aids in teaching.

Field Book of Nature Activities. By William Hillcourt. G. P. Putnam's Sons, New York City. 1950. 320 pages. Excellent material on many subjects considered in this Leaflet.

Leader's Nature Guide. By Marie E. Gaudette. Girl Scouts of the United States of America, New York City. 1942. 94 pages. Many helpful suggestions.

How to Make a Home Nature Museum. By Vinson Brown. Little, Brown and Company, Boston, Massachusetts. 1954. 214 pages. Many suggestions for arranging meaningful collections, and for displaying them effectively.

Modern Science Teaching. By Elwood D. Heiss, Ellsworth S. Obourn, and Charles W. Hoffman. The Macmillan Company, New York City. 1950. 462 pages. A general discussion of the principles of science teaching, of science classrooms and their equipment, and of sensory aids for teaching science.

The Junior Book of Insects. By Edwin Way Teale. E. P. Dutton and Company, New York City. 1953, 249 pages. General information and help for collectors of insects.

Plants; a Guide to Plant Hobbies. By Herbert S. Zim. Harcourt, Brace and Company, New York City. 1947. 398 pages. Helpful to the plant collector.

First Book of Stones. By M. B. Cormack. Franklin Watts, Inc., New York City. 1950. 93 pages. Good suggestions for intermediate grades.

Rocks and Their Stories. By Carroll Lane Fenton and Mildred A. Fenton. Doubleday and Company, New York City. 1951. 112 pages. For seriously interested students and collectors.

Minerals; Their Identification, Uses, and How to Collect Them. By Herbert S. Zim and Elizabeth K. Cooper. Harcourt, Brace and Company, New York City. 1943. 368 pages. High school age.

The Children's Leaflets for 1955-56

The first of the children's Leaflets for the year, entitled *Air-borne*, is *ready for distribution now*. You may have it as soon as you return the yellow application card which accompanies this Leaflet. It is planned especially for use in the early fall months. Written by Verne N. Rockcastle, of the State University Teachers College at Brockport, it contains fascinating suggestions for outdoor experiences with, and indoor studies of, air-borne seeds and fruits, air-borne animals, and other air-borne things. It offers many opportunities to develop attractive and worthwhile science-center projects.

The Winter number will deal with the difficult question of how plants make food and other plant products. It will outline experiments and suggest activities to help elementary-school children to better understand this process.

The Spring 1956 number bears the intriguing title, *Underfoot*, and is the work of Miss Dora Worbs, graduate assistant in nature, science, and conservation education.

The Radio Program, "This Week in Nature"

By Richard B. Fischer

The weekly radio program, *This Week in Nature*, continues on Friday at 2:15 p.m. on Station WHCU -AM and FM. Formerly heard over the Rural Radio Network, it was one of many programs withdrawn in May during a reorganization.

When I assumed responsibility for the program two years ago, I made no attempt to continue the discussions with children for which Professor Palmer was so well known. I did, however, try to choose appropriate subjects for classroom audiences.

As time passed, the format and the material slowly changed. A number of guests, who were particularly well informed on various natural history matters, helped to present material which I felt would be of interest to teachers, students, and some older listeners. A series of programs was given in which an attempt was made to show how musical composers depicted nature and how they wove nature themes into their works.

The majority of the programs, however, were aimed at the schoolroom. The material of each program is related to the season, and I have tried to handle the subject matter as an elementary or junior-high-school teacher would treat it.

Now, after two years, I feel that a number of questions concerning the program need to be answered

by the teachers of the State. I earnestly seek your comments, criticisms, and suggestions. I should like to know, for example, whether you prefer a return to the type of program you heard before my sponsorship. Is my material and its manner of presentation useful to you, the classroom teacher for whom it is intended? Do some areas of natural history receive too little attention, others too much? Are there particular types of programs you would like to hear more often? Would a different time be more convenient?

The 1955 Cornell Conservation Workshop

By Richard B. Fischer, *Director*

As in the past, facilities and instructional staff for the 1955 Cornell Conservation Workshop, August 15 to 19, were provided by the College of Agriculture at Cornell University. Generous, enthusiastic financial support again came from the New York State Conservation Council. Its money provided 50 scholarships which were awarded to teachers, supervisors and administrators from all parts of the State.

It might be well to say here that the Council is not a State organization. It is an independent group made up of fish, game, and conservation clubs throughout the State. The Council, in turn, is the New York State affiliate of the independent, non-profit National Wildlife Federation.

Two counties—Montgomery and Warren—sent representatives to the Workshop for the first time. That is encouraging, yet three counties remain unrepresented—Genesee, Seneca, and Greene. If you are teaching in one of these counties and wish to be considered for a scholarship in 1956—or if you know of someone who would benefit from the Workshop experience—won't you please write to me? We would like to extend our influence for the cause of conservation into those areas.

Last year we were pleased to announce the first cabin in our planned development program for the Arnot Forest, scene of the Workshops. It was contributed and erected by the Niagara County Federation of Sportsmen, in time for the 1954 Workshop. Since then five more cabins have brought us to the halfway mark in our program. These buildings were contributed as follows: Cabin number 2 was given by the Tonawanda Sportsmen's Club of North Tonawanda; number 3 was a gift of Mr. Ryan Norton, a lumberman and ardent conservationist of Cattaraugus County; cabin number 4 was a joint

gift from the Sportsmen's Federation of Allegany, Steuben, Chautauqua, and Cattaraugus Counties and the Soil Conservation Districts in Allegany and Steuben Counties. The Erie County Sportsmen's Alliance was the donor of cabin number 5; the Waverly Sportsmen's Club gave us number 6.

It has been a keen pleasure to share in the Arnot development program with our extension conservationists Harlan Brumsted, Fred Winch, Harry Kerr, and Gordon Cunningham, and our technician Douglas Payne. To erect the cabins, the donors have sent work crews to the Arnot. We have joined them there, and in a single day have put up a 16-by-18-foot building. You may have seen accounts of these building bees in your local papers.

Everyone who uses the Arnot buildings is indebted to the fine organizations which have so generously aided in providing them. We at Cornell draw courage and inspiration from their generosity and we shall continue to do our best to foster and nurture the good cause that is ours.

New York State's Largest Elms

During the past year the New York State Arborist's Association sponsored a search for the largest American elm tree in the State. Two of the ten large trees entered in the survey were reported by readers of the Teachers' Leaflet for September 1954. Four of these trees are now more than 20 feet in girth at 4½ feet above ground. Most of them were probably good sized trees before early colonial times.

The largest elm reported in the survey is known as the Bellinger Line Tree. It is on the Bellinger Farm south of Sharon (U.S. Route 20), in Schoharie County. The tree measures 23 feet 4 inches in girth, has a spread of 110 by 120 feet, and is approximately 85 feet in height. With an area spread of about 13,200 square feet, it shades about one-third acre. This large elm is in good condition for a tree of its size and age. It is in moist soil along a fence row in a pasture.

Second in size is the Harder elm, at Hurley, Ulster County, New York. It measures only 1 inch or so less in girth than the Bellinger elm. The third large elm is in the town of Gerry, Chautauqua County, on the property of Lee Smith. Its reported girth is 22 feet 6 inches. The Johnson Hall elm, in Johnstown, Fulton County, New York, ranks fourth.

A similar search for the State's largest sugar maple tree is now under way. Can New York State teachers and children help here, too? Information and entry blanks may be obtained from A. M. S. Pridham, Cornell University, Ithaca, New York.

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